

Proposal Information Template for: **Pool and Spa Measure Revisions**

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Proposal Information Template – Pool and Spa Measure Revisions

2008 Appliance Efficiency Standards

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Purpose

This document is a report template to be used by researchers who are evaluating proposed changes to the California Energy Commission’s (Commission) appliance efficiency regulations (Title 20, Cal. Code Regs., §§ 1601 – 1608) This report specifically covers revisions to current Swimming Pool and Portable Electric Spa appliance standards which were adopted by the California Energy Commission on Oct 11, 2006.

This template covers the following 9 pool and spa topics:

- Replacement pool pump motors
- Performance basis motor efficiency standard
- High-efficiency multi-speed motor and control clarifications
- Booster pumps and motors
- 48-Frame above-ground pool pumps and motors
- Spa test method revisions
- Hydraulic component friction loss
- Automatic pool cleaning systems
- Miscellaneous language changes

Background

Residential Pool Pumps and Portable Electric Spas were first included in the 2005 Title-20 appliance standards that were adopted at the end of 2005. Residential Swimming Pool standards have been proposed for the 2008 Title-24 building standards which are expected to be adopted in early 2008. The 2005 Title-20 standards regulated pool pump motor types, required testing and listing of pool pump motor combinations and portable electric spas, and set minimum efficiency levels for portable electric spas, all which were effective January 1st, 2006. In addition, multi-speed motors and controls were required for pool pumps of greater than 1 HP effective January 1st, 2008. The 2008 Title-24 standards require pool design standards that include minimum pool turnover times and maximum flow velocities.

Since the implementation of the standards there have been ongoing discussions between PG&E and the pool industry (principally the Association of Pool and Spa Professionals, APSP) in regards to updates and revisions including:

- Accommodate new pool equipment such as variable-speed motors
- Clarify whether or not replacement motors are covered
- Revise the spa test method based on results of industry testing

The original standards only covered pool filtration pumps for residential in-ground pools. There are numerous other pool related equipment which can have significant effects on total pool energy use including:

- Booster pumps and motors
- Above-ground pools
- Automatic pool cleaners
- Ancillary equipment such as backwash valves, filters, and solar heaters

Overview

Replacement pool pump motors

The current pool pump standards do not refer to pool pumps, pool pump motors, and pool pump motor combinations consistently. Because of this, it is currently the interpretation of the CEC that the standards do not cover replacement pool pump motors, although this was the intent of the standards. The definition of Residential Pool Pump should be changed to explicitly include both the pump and pump motor.

Performance basis motor efficiency standard

Section 1605.3(g)(5) currently regulates the efficiency of pool pump motors prescriptively by not allowing the sale of split-phase or capacitor start–induction run types. Although in general PSC and cap-start cap-run motor types are more efficient, on an individual basis this is not necessarily so as an inexpensive PSC motor can be less efficient than a well built cap-start induction run type. In order to provide manufacturers with the flexibility to make a cost-effective decision, 1605.3(g)(5) should be changed to a performance basis based on data submitted for listing of pool pumps.

There are currently 91 pool pumps listed in the CEC database, consisting of 67 with two-speed motors and 24 with single-speed motors. Efficiency ranges of each motor type are summarized in the table below.

<i>Type</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Average</i>
Single-speed	0.51	0.76	0.65
Two-speed low	0.35	0.45	0.55
Two-speed high	0.65	0.82	0.74

Because small motors and the lower-speed of multi-speed motors tend to have low efficiency, an efficiency level must be chosen with care, as imposing too high a level could

increase the cost of small motors and provide an unintended incentive towards larger pumps.

High-efficiency multi-speed motor and control clarifications

When the current standards were written the vast majority of residential pool pump motors were either single-speed or two-speed. Since then manufacturers have brought out an increasing variety of multi-speed and variable-speed motors. These can provide significant energy savings over conventional motors, but their performance is more difficult to characterize in terms of the standards. Two sections need to be revised in order to correctly account for multi-speed motors: 1) The test method must be run at a number of specified fractions of maximum speed, and 2) section 1605.3(g)(5)(B) needs to define what the lowest speed is.

Booster pumps and motors

Booster pumps are used to overcome the added friction and provide additional flow for auxiliary pool loads such as automatic pool cleaners, water features, solar heating panels, and spas. Current standards only address filtration pumping and exclude booster pumps from regulation.

48-Frame above-ground pool pumps and motors

There are over 350,000 above-ground pools in California, which range in size from 3,500 to 10,000 gallons, with an average size of about 7,500 gallons. The major difference between above-ground and in-ground pool filtration systems is that above-ground systems use 48-frame rather than 56-frame motors, usually of cap-start induction run type. These are the least efficient of available pool pump motors.

Spa test method revisions

PG&E, APSP, and a number of spa manufacturers have been meeting to discuss problems the manufacturers are having complying with the current spa test method. Some manufacturers are finding it difficult or impossible to qualify their smaller spas and question the accuracy of the current test method. To address this, APSP has begun development of an ANSI spa test method based on the CEC test method and, as part of this work, will be testing a variety of spas at a new test facility at Cal Poly San Luis Obispo. Refinements to the spa test procedure developed from this project should be incorporated into the new standards as appropriate.

Hydraulic component friction loss

The new Title-24 pool regulations address the system losses of a pool design including flow rates and component friction losses. Two components that can add significantly to the system friction loss, but that are not well characterized in sales literature, are elbows and backwash valves. Elbows can be hard 90, short sweep, or long sweep, but the hard 90 style is used almost exclusively due to its low cost and compact shape. The Title-24 analysis showed sweep elbows to be cost effective, but there is a lack of readily available friction loss data and no easy way to identify low-friction fittings. Backwash valves, used to backwash

sand and DE filters, can add significantly to the overall system friction loss. Although there are valves available with low pressure drop, there is no way to easily identify them.

Automatic pool cleaning systems

Two thirds of California pools have an automatic pool cleaner. There are three principle types of automatic pool cleaners: pressure-side, suction-side, and electric. Suction-side cleaners add significant load to the filtration pump, pressure-side cleaners use an added booster pump, and electric cleaners power themselves. If a reasonable energy efficiency test method can be developed, then the testing and listing of automatic pool cleaning systems would be the first step towards regulating their efficiency.

Miscellaneous Language Changes

The new Title-24 pool standards rely on a new pool system curve to size pumps for pools of greater than 25,000 gallons. This curve, referred to as "Curve C", was suggested by pool pump stakeholders and represents the system curve of a well designed, low-pressure drop pool. Adding Curve C to the test and listing requirements of filtration pumps will allow the data to be easily used by Title-24.

Recommendations

Replacement pool pump motors

Make the following changes in sections 1602 and 1604 to explicitly include replacement pool pump motors in the regulations:

1602(g)

"Residential pool pump" means a pump-[motor combination](#) used to circulate and filter pool water in order to maintain clarity and sanitation, [and includes the centrifugal pump and the pump motor](#).

1604(g)

(3) Test Method for Residential Pool Pumps [and Replacement Motors](#)

(B) ANSI/HI 1.6-2000 shall be used for the measurement of pump ~~and motor combinations~~ efficiency.

Performance basis motor efficiency standard

Make the following changes in section 1605.3(g) to regulate the performance of pool pump motors:

(5) Residential Pool Pumps [and Replacement Motors](#).

(A) **Motor Efficiency.** Pool pump motors manufactured on or after January 1, 2006 ~~may not be split phase or capacitor start—induction run type~~ [shall have an efficiency of at least 0.60 when operated at their highest speed](#).

High-efficiency multi-speed motor and control clarifications

Add the following definition to section 1602(g):

“Auxiliary pool load” means a feature or device that circulates pool water, in addition to that required for pool filtration, including, but not limited to, solar pool heating systems, filter backwashing, pool cleaners, waterfalls, fountains, and spas.

Make the following changes in section 1605.3(g)(5) to better accommodate high-efficiency multi-speed motors and to clarify control specifications as they relate to multi-speed products:

(B) **Two-Speed Capability.**

- (i) **Pump Motors.** Pool pump motors with a capacity of 1 HP or more which are manufactured on or after January 1, 2008, shall have the capability of operating at two or more speeds with ~~a low~~ the lowest speed having a rotation rate that is no more than one-half of the motor’s maximum rotation rate.
- (ii) **Pump Controls.** Pool pump motor controls manufactured on or after January 1, 2008 shall have the following minimum capabilities:
 - (a) The ability to operate the pool pump at two or more speeds.
 - (b) A filtration speed that is the default when no auxiliary pool loads are operating and is no more than one-half of the motor’s maximum rotation speed.
 - (c) A high-speed override capability that returns to the filtration speed within twenty four hours.

Booster pumps and motors

Add booster pumps and motors to the pool products that must be tested and listed.

48-Frame above-ground pool pumps and motors

Address efficiency of 48-Frame above ground products.

Spa test method revisions

Incorporate refinements to the spa test procedure as developed by APSP and Cal Poly.

Hydraulic component friction loss

Add backwash valves and elbows to the pool products that must be tested and listed.

Add the following definition to section 1602(g):

“Backwash valve” means a diverter valve designed to backwash filters located between the circulation pump and the filter, including, but not limited to, slide, push-pull, multi-port, and full-flow valves.

Add the following to section 1607(d):

- (11) **Residential Swimming Pool Elbows.** Each fitting of 90° schedule 40 swimming pool pipe shall be marked, permanently and legibly on an accessible and conspicuous place

on the fitting, in characters no less than 1/8”, the pressure drop of the fitting, in equivalent diameters of pipe of the same diameter as the fitting.

Automatic pool cleaning systems

If a test method for automatic pool cleaning system efficiency can be developed, add automatic pool cleaning systems to the pool products that must be tested and listed.

Miscellaneous Language Changes

1604 (g) (3) Test Method for Residential Pool Pumps

(C) ~~Two~~ **Three** curves shall be calculated:

Curve A: $H = 0.0167 \times F^2$

Curve B: $H = 0.050 \times F^2$

Curve C: $H = 0.0082 \times F^2$

Where:

H is the total system head in feet of water.

F is the flow rate in gallons per minute (gpm).

(D) For each curve (~~A&B~~**&C**), the pump head shall be adjusted until the flow and head lie on the curve. The following shall be reported for each curve and pump speed (two-speed pumps shall be tested at both high and low speeds). See Table V.

1606 Table V Data Submittal Requirements

	<i>Appliance</i>	<i>Required Information</i>	<i>Permissible Answers</i>
G	Residential Pool Pumps	Motor Construction	PSC, Cap Start-Cap Run, ECM, Cap Start-induction run, split-phase
		Motor Design	Single-speed, dual-speed, multiple-speed, variable-speed
		Motor has Capability of Operating at Two or More Speeds with the Low Speed having a Rotation Rate that is No More than One-Half of the Motor’s Maximum Rotation Rate	Yes, no
		Pool Pump Motor Service Factor	
		Motor Efficiency (%)	
		Rated Horsepower	
		Flow for Curve ‘A’ (in gpm)	
		Power for Curve ‘A’ (in watts)	
		Energy Factor for Curve ‘A’ (in gallons per watt-hour)	
		Flow for Curve ‘B’ (in gpm)	
		Power for Curve ‘B’ (in watts)	
		Energy Factor for Curve ‘B’ (in gallons per watt-hour)	
		<u>Flow for Curve ‘C’ (in gpm)</u>	
		<u>Power for Curve ‘C’ (in watts)</u>	
<u>Energy Factor for Curve ‘C’ (in gallons per watt-hour)</u>			

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