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APSP Pump & Motor Comments on Docket No. 15-AAER-02

Additional submitted attachment is included below.

APSP
The Association of Pool & Spa Professionals®
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February 29, 2016

California Energy Commission
Docket No. 15-AAER-02
1516 9th Street, MS-4
Sacramento, CA 95814

To Whom It May Concern:

The Association of Pool & Spa Professionals (APSP) has been proactive in supporting energy efficiency through the adoption of the APSP-15, American National Standard for Residential Swimming Pool and Spa Energy Efficiency, work on national legislative and regulatory efforts, as well as working with the California Investor Owned Utilities (CAIOU's) in supporting Title 20 and the update of this regulation. You will not find another industry group more supportive of efforts to increase energy efficiency standards in the pool and spa industry. As the industry reviews the California Energy Commission (CEC) Staff Report on the Analysis of Energy Efficiency for Pool Pumps and Motors, and Spas, we have identified the following issues with the proposal.

First, the low speed efficiency levels are too high to meet. As was noted in the public workshop, there are currently no motors that are available in the market that can meet the Tier 2 low speed level outside of the electronically commutated motor (ECM) technology. This was further clarified during the workshop where there were a few errors that were noted in the CEC Appliance Database which the industry is working diligently to update. The CEC had noted their intent to keep the regulation technology neutral. By prescribing a level where no other technology is available to meet the standard, it breaks the spirit of this technology-neutral approach.

Secondarily, as noted in the Table 1 in the Appendix, there is an issue with being able to meet Tier 1 low speed efficiency levels given present technology. The majority of the problem areas are related to lower horsepower. There are fixed losses that are inherent in the pool pump motor that become larger part of the friction and windage that the motor has to overcome as the motor horsepower becomes lower. There is only so much copper and iron that can be designed into the motor to increase the efficiency to overcome these losses.

Another issue that we have also identified is the incremental cost difference in the two tiers. As expressed in Tables 2A and 2B of the Appendix, you will clearly see the various levels of pricing on the internet for single speed, two speed, and variable speed motors. These differences are not congruent with the values that are detailed out in the CEC staff report. We hope that the CEC will update the incremental costs needed to achieve Tier 1 and Tier 2 levels. We hope that the CEC will reach out to manufacturers and independently solicit information on end user pricing while providing the manufacturers with protection to confidential business information.

The CEC also requested data on the life of motors as the staff report had assumed a 10 year operating life of the pump motor. As detailed out in the Consortium for Energy Efficiency (CEE)

High Efficiency Residential Swimming Pool Initiative, Regal Beloit had commented that they saw a pump motor life that varied between 5 to 7 years. Various factors can contribute to the variation in the life of the pump motor (e.g. sea salt environment, type of seal used, installation procedures by contractors, usage of the pump). Although it is hard to get detailed life data from the field, this is the best estimate that the industry has on the typical life of a pool pump motor. Regardless of the actual lifespan, it is widely accepted that higher efficiency totally enclosed fan cooled (TEFC) motors run cooler and will last longer than the typical open drip proof (ODP) induction motor designs.

It is also believed that enforcement of the regulation will be required to ensure compliance. In the absence of enforcement, non-compliant products can be easily transported from neighboring states and ordered online through internet distributors. The lack of enforcement only undermines the reputable contractor who chooses to perform work exclusivity under the CEC regulation's intent.

APSP would also like to review the proposed increase in scope to cover all pool pumps less than five total horsepower, including booster pumps and commercial pumps. Most booster pumps in the industry are just above 1 THP (e.g. 1.25 THP). Under the proposed scope, these pumps would either need to be multi-speed or decrease their rating and hence performance to less than 1 THP. A multi-speed pump for a booster pump is impractical as low speed operation would not provide the appropriate pressure. Along the same lines, reducing the pump performance to less than 1 THP could, in turn, limit cleaner performance, resulting in longer cleaner operation and the potential for overall greater energy consumption.

For commercial pools, local and/or state codes requiring a fixed flow (turnover) has often limited the use of multi-speed pumps. The proposed change to include commercial pumps does represent a substantial opportunity to save energy, but the industry must also be cognizant of turnover requirements and determine how best to balance the needs of sanitization, filtration, and energy efficiency.

Lastly, PMSM motors for portable pool pumps are generally regarded to be a very energy efficient design. The small "epoxy style" pumps used for the smaller storable pools are most closely identified with the characteristics of PMSM type motors. In discussing testing results with a 3rd party lab, the nature of this integrated pump motor construction, considering also their extremely low rated power, creates an issue in measuring the output. For instance, the use of a normal dyno will instantly lock the rotor. In order to obtain any result on output, a hybrid dyno had to be used. Even with using the hybrid dyno, the rotor tended to lock up very quickly. Output values utilizing the currently available measurement equipment may have a margin of error given the difficulty of preventing rotor lock-up. This may in part explain why the motor efficiency values determined during testing do not reflect the values anticipated for PMSM motors. Also, these small integrated filter pump motor combinations may not be easily tested for efficiency outside of their very specific application of use to circulate storable pool water.

Much of the information that can be provided to support the CEC in development of the next Title 20 regulation on the pool pump motor can be provided by individual manufacturers; however, there is currently no protection of confidential and proprietary data. We are proposing an extension to the process so that we can provide the data within some structure where individual manufacturer data can be protected.

We thank the CEC for its time and consideration.

Respectfully submitted,

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Appendix:

TIER1 (2018) 70% hi / 50% low	TIER2 (2021) 80% hi / 65% low	Notes:
<1HP 70%	<1HP 80%	
>1HP must meet efficiency levels at SFHP (requirement for 2-speed removed)	>1HP must meet efficiency levels at SFHP (requirement for 2-speed removed)	

frame	nameplate detail	electrical type	Hi speed SFHP capacity	Hi speed Eff% @SFHP	Low speed SFHP capacity	Low speed Eff% at SFHP	TIER1	TIER2	Notes
48 ECM	115V 10.0A 0.85HPmax	ECM	0.85	78.3%			OKAY TIER1	OKAY TIER2	
48 ECM	208-230V 10.5-10.0A **1.65HPmax**	ECM	1.65	82.5%	0.206	72.8%	OKAY TIER1	OKAY TIER2	
48 ECM	230V 11.0A **1.85HPmax**	ECM	1.85		0.231		OKAY TIER1	OKAY TIER2	
48 ECM	208-230V 10.5A **2.7HPmax**	ECM	2.7	81.8%	0.330	72.0%	OKAY TIER1	OKAY TIER2	
48	115V 7.0A **.5HP 1.0SF**	Split Phase	0.50	60.0%	---	---	X - fails 80%	X - fails 80%	
48	115V 11.0A **.75HP 1.0SF**	Split Phase	0.75	62.0%	---	---	X - fails 80%	X - fails 80%	
48	115V 11.0A **.75HP 1.0SF**	SP	0.75	68.7%	---	---	X - fails 80%	X - fails 80%	
48	115V 12.0A **1.0HP 1.0SF**	SP	1.00	64.2%	---	---	X - fails 80%	X - fails 80%	
48	115V 10.0A **.75HP 1.0SF**	SP	0.75	62.5%	---	---	X - fails 80%	X - fails 80%	
48	115V 12.0A **1.0HP 1.0SF**	SP	1.00	67.0%	---	---	X - fails 80%	X - fails 80%	
48	115V 15.0A **1.5HP 1.0SF**	SP	1.50	71.0%	---	---	OKAY TIER1	X - fails 80%	
48	115V 13.8A (1.5HP SPL) = true 1.0HP 1.0SF	SP	1.00	66.3%	---	---	X - fails 80%	X - fails 80%	
48	115V 13.5/4.4A (1.5/.167SPL) = true 1.0/.25HP 1.0SF	SP	1.00	64.3%	0.667	37.6%	X - fails 80%	X - fails 80%	
48	115/208-230V MaxAmps=10.0/6.0-5.0A **.75HP 1.27SF**	CapSt.	0.95	76.9%	---	---	X - fails 80%	X - fails 80%	
48	115/208-230V MaxAmps=13.3/6.9-6.8A **1.0HP 1.25SF**	CapSt.	1.25	77.3%	---	---	OKAY TIER1	X - fails 80%	
48	115/208-230V MaxAmps=16.5/9.2-8.5A **1.5HP 1.1SF**	CapSt.	1.65	75.5%	---	---	OKAY TIER1	X - fails 80%	
48	115/208-230V MaxAmps=9.2/4.7-4.6A **.75HP 1.27SF**	CSCR	0.95	75.0%	---	---	OKAY TIER1	X - fails 80%	
48	115/208-230V MaxAmps=14.4/7.6-7.3A **1.5HP 1.1SF**	CSCR	1.65	78.2%	---	---	OKAY TIER1	X - fails 80%	
48	115/208-230V MaxAmps=11.0/5.7-5.6A **1.0HP 1.25SF**	CSCR	1.25		---	---	OKAY TIER1		
48	115/208-230V MaxAmps=17.4/10.6-8.8A **2.0HP 1.05SF**	CSCR	2.10	81.0%	---	---	OKAY TIER1	OKAY TIER2	
48	230V SFA=7.7/2.8A **1.5/.25HP 1.1SF**	CSCR	1.65	73.6%	0.275	44.4%	fails low 50%	fails hi 80% / low 65%	
48	230V MaxAmps=10.0/3.0A **2.0/.25HP 1.1SF**	CSCR	2.20	77.4%	0.275	48.0%	fails low 50%	fails hi 80% / low 65%	
48	115/230V 11.0/5.5A **.75HP 1.0SF**	CapSt.	0.75	67.5%	---	---	X - fails 80%	X - fails 80%	
48	115/230V 15.0/7.5A **1.0HP 1.1SF**	CapSt.	1.10	69.0%	---	---	X - fails 80%	X - fails 80%	
48	115/230V 18.6/9.3A **1.5HP 1.0SF**	CapSt.	1.50	75.0%	---	---	OKAY TIER1	X - fails 80%	
48	115/230V 13.0/6.5A **.75HP 1.32SF**	CSCR	0.99	73.6%	---	---	X - fails 80%	X - fails 80%	
48	115/230V 19.4/9.7A **1.5HP 1.33SF**	CSCR	2.00	78.1%	---	---	OKAY TIER1	fails 80%	
48	230V 11.2A **2.0HP 1.25SF**	CSCR	2.50	79.0%	---	---	OKAY TIER1	fails 80%	
48	230V 10.0A **2.5HP 1.0SF**	CSCR	2.50	79.0%	---	---	OKAY TIER1	fails 80%	
56	115/208-230V SFA 11.2/6.0-5.6A **.75HP 1.67SF**	PSC	1.25	71.0%	---	---	OKAY TIER1	fails 80%	
56	208-230/115V SFA=6.0-5.5/11.0A **.75HP 1.85SF**	PSC	1.39	76.5%	---	---	OKAY TIER1	fails 80%	
56	208-230/115V SFA=8.5-7.8/15.6A **1.0HP 1.85SF**	PSC	1.85	79.5%	---	---	OKAY TIER1	fails 80%	
56	208-230/115V SFA=11.0-10.2/20.4A **1.5HP 1.6SF**	PSC	2.40	81.9%	---	---	OKAY TIER1	OKAY TIER2	
56	115/208-230V SFA=8.6/5.0-4.3A **.5HP 1.99SF**	CSCR	1.00	81.0%	---	---	OKAY TIER1	OKAY TIER2	
56	115/208-230V SFA=11.6/7.0-5.8A **.75HP 1.85SF**	CSCR	1.39	80.0%	---	---	OKAY TIER1	OKAY TIER2	
56	115/208-230V SFA=15.0/8.8-7.5A **1.0HP 1.85SF**	CSCR	1.85	80.0%	---	---	OKAY TIER1	OKAY TIER2	
56	115/208-230V SFA=20.0/12.0-10.0A **1.5HP 1.6SF**	CSCR	2.40	80.0%	---	---	OKAY TIER1	OKAY TIER2	
56	208-230V SFA=12.0-11.0A **2.0HP 1.35SF**	CSCR	2.70	82.0%	---	---	OKAY TIER1	OKAY TIER2	
56	208-230V Amps=8.6-8.0/3.2A **1.5/.19HP 1.25SF**	Hipsc, SPlow	1.88	74.9%	0.238	45.7%	fails low 50%	fails hi 80%/ low 65%	
56	208-230V Amps=11.0-10.3/3.5A **2.0/.25HP 1.2SF**	Hipsc, SPlow	2.40	81.0%	0.300	50.8%	OKAY TIER1	fails low 65%	
56	208-230V Amps=13.0-12.0/4.2A **2.5/.33HP 1.1SF**	Hipsc, SPlow	2.75	79.0%	0.363	53.0%	OKAY TIER1	fails hi 80%/ low 65%	
56	115V SFA=14.6/4.7A **(1.0/.12HP 1.4SF)**	Hipsc, SPlow	1.40	66.0%	0.168	37.9%	fails hi 70% / low 50%	fails hi 80%/ low 65%	
56	230V SFA=7.8/3.0A **(1.5/.19HP, 1.1SF)**	Hipsc, SPlow	1.65	74.5%	0.209	42.8%	fails low 50%	fails hi 80%/ low 65%	
56	230V SFA=10.0/3.5A **(2.0/.25HP, 1.1SF)**	Hipsc, SPlow	2.20	76.1%	0.275	46.5%	fails low 50%	fails hi 80%/ low 65%	
56	230V SFA=11.0/4.0A **(2.5/.31HP, 1.0SF)**	Hipsc, SPlow	2.50	77.6%	0.313	56.0%	OKAY TIER1	fails hi 80%/ low 65%	
56	115V SFA=12.2/2.0A **.75/.10HP 1.67SF**	Hipsc, LOWcapstcaprun	1.25	68.0%	0.167	53.0%	X - fails hi 70%	fails hi 80%/ low 65%	Just a small design tweak to get to Tier1
56	230V SFA=5.8/.9A **.75/.10HP 1.67SF**	Hipsc, LOWcapstcaprun	1.25	73.8%	0.167	50.6%	OKAY TIER1	fails hi 80%/ low 65%	
56	230V SFA=7.4/1.4A **1.0/.12HP 1.65SF**	Hipsc, LOWcapstcaprun	1.65	73.0%	0.198	50.0%	OKAY TIER1	fails hi 80%/ low 65%	
56	208-230V SFA=8.5/1.5A **1.0/.12HP 1.85SF** (230V SFA=10.0/1.6A 1.5/.19HP 1.47SF)	Hipsc, LOWcapstcapru	1.85 (2.205)	73.5% (75.5%)	0.222 (.279)	54.0% (57.6%)	OKAY TIER1	fails hi 80%/ low 65%	
56	208-230V SFA=10.7/1.7A **1.5/.19HP 1.60SF** (230V SFA=11.0/1.8A 2.0/.25HP 1.30SF)	Hipsc, LOWcapstcapru	2.4 (2.6)	80.0% (80.5%)	0.304 (.325)	56.0% (57.5%)	OKAY TIER1	fails hi 80%/ low 65%	
56	208-230V SFA=12.4-11.8/2.4-2.3A **2.0/.25HP 1.35SF** (230V SFA=15.0/2.6A 3.0/.38HP 1.15SF)	Hipsc, LOWcapstcapru	2.7 (3.45)	79.0% (80.1%)	0.338 (.437)	52.0% (58.0%)	OKAY TIER1	fails hi 80%/ low 65%	

Table 1 – Pump Motor Efficiency

Rated HP	Approx. Total HP	Pump Type	OEM “A”	OEM “B”	OEM “C”
0.5	< 1	Single Speed Pump	$490	$500	$530
0.75	1-1.5	Single Speed Pump	$470	$590	$570
1	1.5-2	Single Speed Pump	$490	$650	$520
1.5	2-2.5	Single Speed Pump	$540	$630	$640
2	2.5-3	Single Speed Pump	$680	$820	$790
3	3.5-4	Single Speed Pump	$800	$890	$930
1	1.5-2	Two Speed Pump	$620	$660	$740
1.5	2-2.5	Two Speed Pump	$710	$800	$890
2	2.5-3	Two Speed Pump	$830	$890	$990
1.5	2-2.5	Variable Speed Pump	$790	$750	$700
3	3.5-4	Variable Speed Pump	$890	$1,020	$1,000

*Source: Amazon.com. Rounded to the nearest $10. Pricing does not include installation.

Table 2A – Pricing Examples, Amazon

Rated HP	Approx. Total HP	Pump Type	OEM “A”	OEM “B”	OEM “C”
0.5	< 1	Single Speed Pump	$450	N/A	$550
0.75	1-1.5	Single Speed Pump	$490	$490	$490
1	1.5-2	Single Speed Pump	$530	$540	$530
1.5	2-2.5	Single Speed Pump	$570	$560	$570
2	2.5-3	Single Speed Pump	$670	$600	$650
3	3.5-4	Single Speed Pump	$810	$890	$830
1	1.5-2	Two Speed Pump	$630	N/A	$650
1.5	2-2.5	Two Speed Pump	$680	$720	$670
2	2.5-3	Two Speed Pump	$810	$790	$760
1.5	2-2.5	Variable Speed Pump	$730	$880	$780
3	3.5-4	Variable Speed Pump	$930	$1,020	$1,230

*Source: inyopools.com. Rounded to the nearest $10. Pricing does not include installation.

Table 2B – Pricing Examples, inyopools.com