

Performance of pool pumps



Legal Notice for Standards

Canadian Standards Association (CSA) standards are developed through a consensus standards development process approved by the Standards Council of Canada. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document's fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party's intellectual property rights. CSA does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA makes no representations or warranties regarding this document's compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA is a private not-for-profit company that publishes voluntary standards and related documents. CSA has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

Intellectual property rights and ownership

As between CSA and the users of this document (whether it be in printed or electronic form), CSA is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA's and/or others' intellectual property and may give rise to a right in CSA and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA reserves all intellectual property rights in this document.

Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

Authorized use of this document

This document is being provided by CSA for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in print or paper form may be distributed only to persons who are authorized by CSA to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and may not permit others to

- alter this document in any way or remove this Legal Notice from the attached standard;
- sell this document without authorization from CSA; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents hereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.



CANADIAN STANDARDS
ASSOCIATION

CSA Standards Update Service

C840-12

February 2012

Title: *Performance of pool pumps*

To register for e-mail notification about any updates to this publication

- go to **www.shop.csa.ca**
- click on E-mail Services under **My Account**
- click on **CSA Standards Update Service**

The **List ID** that you will need to register for updates to this publication is **2421806**

If you require assistance, please e-mail **techsupport@csa.ca** or call 416-747-2233.

Visit CSA's policy on privacy at **www.csagroup.org/legal** to find out how we protect your personal information.

Currently in preview, click buy full version

C840-12
Performance of pool pumps



® Registered trade-mark of Canadian Standards Association.

*Published in February 2012 by Canadian Standards Association
A not-for-profit private sector organization
5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6
1-800-463-6727 • 416-747-4044*

Visit our Online Store at www.shop.csa.ca



The Canadian Standards Association (CSA) prints its publications in Rolland Enviro100, which contains 100% recycled post-consumer fibre. It is EcoLogo and Processed Chlorine Free certified, and was manufactured using biogas energy.

To purchase CSA standards and related publications, visit CSA's Online Store at www.shop.csa.ca or call toll-free 1-800-463-6727 or 416-747-4044.

ISBN 978-1-55491-657-3

© Canadian Standards Association — 2012

All rights reserved. No part of this publication may be reproduced to any form whatsoever without the prior permission of the publisher.

Contents

Technical Committee on Residential Equipment *iv*

Subcommittee on Pool Pumps *vi*

Preface *vii*

0 Introduction *1*

1 Scope *1*

2 Reference publications *2*

3 Definitions *2*

4 General requirements *3*

5 Testing *3*

6 System curves *4*

7 Determining the energy factor *5*

8 Marking *5*

9 Reporting *5*

Annex A (informative) Considerations in pool pump calculations *7*

Annex B (informative) Imperial measurements for pool pump calculations *9*

Technical Committee on Residential Equipment

G.R. Hamer	BC Hydro, Burnaby, British Columbia	<i>Chair</i>
D.C. Dodge	Efficiency Nova Scotia Corporation, Halifax, Nova Scotia	<i>Vice-Chair</i>
L. Boutin	Hydro-Québec, St-Bruno, Québec	
R.L. Cane	Caneta Research Inc., Mississauga, Ontario	
D. Carr	Ontario Power Authority, Toronto, Ontario	
K.N. Delves	Natural Resources Canada, Ottawa, Ontario	
S. Grubbe	Calgary, Alberta	
E. Grzesik	Mississauga, Ontario	
W. Hassan	Northern Lights Asset Management Ltd., Oakville, Ontario	
G.D. Henriques	Henriques Consulting, Richmond, British Columbia	
J. Hodge	Toronto, Ontario	
A. Kelly	Canadian Electricity Association, Ottawa, Ontario	
S. Krsikapa	Ontario Ministry of Energy, Toronto, Ontario	
T.K. Lau	BC Hydro, Burnaby, British Columbia	
C. LeBlond	LTE Hydro-Québec, Shawinigan, Québec	
C. Lesage	Giant Factories Inc.-Usines Giant Inc., Montréal-Est, Québec	
C. Li	Hydro One Networks Inc., Toronto, Ontario	

R. Martel	Electro-Federation Canada, Toronto, Ontario	
E. Milakowski	Ontario Ministry of Energy, Ottawa, Ontario	
R. Mortazavi	Natural Resources Canada, Ottawa, Ontario	
T.J Orris	AMCA International, Inc., Arlington Heights, Illinois, USA	
S. Stricker	Stricker Associates Inc., Thornhill, Ontario	
K.A. Veerman	FortisBC Inc., Kelowna, British Columbia	
W.R. Wood	Pool & Hot Tub Council of Canada, Brampton, Ontario	
M. Hopkins	Canadian Standards Association, Mississauga, Ontario	<i>Project Manager</i>

Subcommittee on Pool Pumps

J. Hodge	Toronto, Ontario	<i>Chair</i>
J.L. Farlow	Pentair Water Pool and Spa Inc., Sanford, North Carolina, USA	<i>Vice-Chair</i>
P. Angers	LTE Hydro-Québec, Shawinigan, Québec	
P. Bach	Pentair Water Pool and Spa Inc., Cambridge, Ontario	
J. Baljon	Speck Pumps, Jacksonville, Florida, USA	
S. Barnes	Pentair Water Pool and Spa Inc., Maricopa, Arizona, USA	
T. Brennan	Natural Resources Canada, Ottawa, Ontario	
E. Grzesik	Mississauga, Ontario	
G.R. Hamer	BC Hydro, Burnaby, British Columbia	
L. Murray	Nidec Motor Corporation, St. Louis, Missouri, USA	
S. Siddiqui	Zodiac Pool Systems, Inc., Modesto, California, USA	
S. Stricker	Stricker Associates Inc., Thornhill, Ontario	
K.R. Theis	Emerson Electric Company Emerson Motor Div, St. Louis, Missouri, USA	
W.R. Wood	Pool & Hot Tub Council of Canada, Brampton, Ontario	
T. Young	Regal Beloit Electric Motors, Inc, Fort Wayne, Indiana, USA	
P. Stancic	Canadian Standards Association, Mississauga, Ontario	<i>Project Manager</i>

Preface

This is the first edition of CSA C840, *Performance of pool pumps*.

This Standard specifies energy performance calculations, marking and reporting requirements for centrifugal pump units used for circulating and filtering water in permanently installed residential swimming pools.

The products currently available in the market place for use in these applications are predominantly rated, marketed and sold using imperial measurements. Although this Standard has been written using metric measure, it was considered critical for the users of this Standard to maintain some correlation to the imperial measures used by the industry. An annex has been included that shows the imperial equivalents to the calculations used by this Standard. In addition, simple conversion formulae have been provided to allow for calculations made in imperial measures to be easily converted to metric format.

CSA acknowledges the use of the California Energy Commission Regulations CEC 2009 *Appliance Efficiency Regulations* – CEC-400-2009-013 (CEC Title 20) in the development of this Standard.

CSA acknowledges that the development of this Standard was made possible, in part, by the financial support of Natural Resources Canada (NRCan).

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This Standard was prepared by the Subcommittee on Performance of Pool Pumps, under the jurisdiction of the Technical Committee on Residential Equipment and the Strategic Steering Committee on Performance, Energy Efficiency, and Renewables, and has been formally approved by the Technical Committee.

February 2012

Note(s):

- (1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
- (2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
- (3) *This publication was developed by consensus, which is defined by CSA Policy governing standardization — Code of good practice for standardization as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this publication.*
- (4) *To submit a request for interpretation of CSA Standards, please send the following information to **inquiries@csa.ca** and include "Request for interpretation" in the subject line:*
 - (a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
 - (b) *provide an explanation of circumstances surrounding the actual field condition; and*
 - (c) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue. Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are published in CSA's periodical Info Update, which is available on the CSA website at <http://standardsactivities.csa.ca>.*
- (5) *CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee. To submit a proposal for change to CSA Standards, please send the following information to **inquiries@csa.ca** and include "Proposal for change" in the subject line:*
 - (a) *Standard designation (number);*
 - (b) *relevant clause, table, and/or figure number;*
 - (c) *wording of the proposed change; and*
 - (d) *rationale for the change.*

C840-12

Performance of pool pumps

0 Introduction

This performance Standard was developed to cover swimming pool pumps intended for use in residential permanently installed swimming pools.

The difficulty with selecting the most efficient pool pump is that when in service, these devices need to perform two different functions that require different pump capabilities. Pumping systems for swimming pools are normally designed to provide the function of circulation and filtration, lasting several hours a day and also that of pool cleaning, requiring a higher flow rate but lasting for a much shorter period of time.

The variation of pump performance with speed is described by the Pump Affinity Laws, which state that:

- The flow is directly proportional to pump rotational speed;
- Pressure is proportional to the square of the rotational speed; and
- Power is proportional to the cube of the rotational speed.

It follows that in order for the pump to change its flow rate between filtering and cleaning functions, the motor must undergo a significant speed change and power change, affecting the efficiency of both the motor and the pump. For example, in order to increase the flow by a factor of two, the speed of the pump must double, and the power required to drive the pump must go up by a factor of 8.

The efficiency of an electric induction motor normally increases from zero at no load to a maximum at full load, and then decreases as the load is increased further. There are also a number of ways of changing the flow rate of pumps running at constant speed with their own set of advantages, disadvantages, costs and efficiency implications. The net effect of operating pumps and motors at lower speeds is that when the motor load is reduced, the efficiency of both the pump and of the motor are also reduced.

Attempts to establish a standard or optimal duty cycle for pool pumps is complicated by the fact that pools tend to be fairly unique. Even when the pool structure itself is of an identical size and design as another pool, the associated mechanical support equipment and piping can vary considerably due to lot size, lot grading, power access point, and numerous other considerations that tend to make each installation unique. It is also necessary to factor in the geographical effects due to length of season, airborne dust concentrations, degree of leaf infestation and other factors that will affect the frequency and duration of the filtering and cleaning processes. These factors all contribute to defining the duty cycle of the pump. The unfortunate result from all of these variables is that a pump deemed as very efficient for a specific pool installation may be inefficient if applied to a similar pool built on different terrain in a different geographic location.

It is the intent of this Standard to keep all the options open and to encourage the industry to find the most efficient and effective solutions. From a user's point of view, the ratio that is most important is the amount of water pumped divided by the amount of energy that had to be used per day (or per season). The factor that best describes these interests is the energy factor in terms of water delivered per unit of energy consumed, considering both filtering and vacuuming operations during the average day. This document has been written so that the energy factor is a prominent measure in determining the most efficient pump/motor combinations.

1 Scope

1.1

The purpose of this Standard is to specify pool pump performance measurements that will facilitate the selection of the most efficient models for performing the combined functions of filtration and pool cleaning.

1.2

This Standard applies to energy performance of centrifugal pump units for the purpose of circulating and filtering water in residential permanently installed swimming pools that require a driver rated output up to and including 3730 watts (5 hp).