HI 40.6-2021

Hydraulic Institute Program Guideline for

Methods for Rotodynamic Pump Efficiency Testing

HYDRAULIC INSTITUTE™

Hydraulic Institute Standard for

Methods for Rotodynamic Pump Efficiency Testing

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Hydraulic Institute Standard

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Foreword (Not part of Standard)

Purpose and aims of the Hydraulic Institute

The purpose and aims of the Hydraulic Institute are to promote the advancement of the pump manufacturing industry and further the interests of the public and to this end, among other things:

a) Develop and publish standards.

b) Address pump systems.

c) Expand knowledge and resources.

d) Educate the marketplace.

e) Advocate for the industry.

Purpose of Standards and Guidelines

a) Hydraulic Institute Standards and Guidelines are adopted in the public interest and are designed to help eliminate misunderstandings between the manufacturer, the purchaser, and/or the user and to assist the purchaser in selecting and obtaining the proper product for a particular need.

b) Use of Hydraulic Institute Standards and Guidelines is completely voluntary. The existence of Hydraulic Institute Standards does not in any respect preclude a member from manufacturing or selling products not conforming to the standards.

Definition of a Standard of the Hydraulic Institute

Quoting from Article XV, Standards, of the By-Laws of the Institute, Section B:

“An Institute Standard defines the product, material, process or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, quality, rating, testing and service for which designed.”

Definition of a Hydraulic Institute Guideline

A Hydraulic Institute Guideline is not normative. The guideline is tutorial in nature, to help the reader better understand the subject matter.

Comments from users

Comments from users of this standard will be appreciated, to help the Hydraulic Institute prepare even more useful future editions. Questions arising from the content of this standard may be directed to the Technical Director of the Hydraulic Institute. If appropriate, the inquiry will then be directed to the appropriate technical committee for provision of a suitable answer.

Revisions

Standards and Guidelines of the Hydraulic Institute are subject to constant review, and revisions are undertaken whenever it is found necessary because of new developments and progress in the art. If no revisions are made for five years, the standards are reaffirmed using the HI balloting procedures.

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responsible for any consequences to an owner, operator, user, or anyone else resulting from reference to the content of this document, its application, or use.

This document does not contain a complete statement of all requirements, analyses, and procedures necessary to ensure safe or appropriate selection, installation, testing, inspection, and operation of any pump or associated products. Each application, service, and selection is unique with process requirements that shall be determined by the owner, operator, or its designated representative.

Units of measurement

Metric units of measurement are used, and corresponding US customary units appear in parentheses. Charts, graphs, and sample calculations are also shown in both metric and US customary units. Because values given in metric units are not exact equivalents to values given in US customary units, it is important that the selected units of measure to be applied be stated in reference to this standard. If no such statement is provided, metric units shall govern.

Committee list

A working committee met many times to facilitate the development of this document. At the time it was developed, the committee had the following members:

Chair – Paul Ruzicka, Xylem Inc. – Applied Water Systems
Vice Chair – Gabor Lechnor, Armstrong Fluid Technology

Committee Members	Company
Al Iseppon	Pentair - Berkeley
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Steve Thompson	TACO, Inc.
Laurent Davis	Wilo USA LLC
Michael Mueller	Flowserve Corporation

Special acknowledgement – peer review

Several independent experts in the industry provided their time to review and evaluate the committee draft. They conducted a thorough review of the material, ensuring the document met the intended goal established by the committee chairs, and provided accurate, coordinated, and relevant information to the reader. Their work was extremely valuable, and the committee thanks all of them for their time and efforts.

Sarah Widder	Cadeo Group LLC

40.6 Methods for rotodynamic pump efficiency testing

40.6.1 Scope

This standard covers efficiency testing of rotodynamic pumps that are included in DOE regulations for energy conservation.[1]

HI 40.6 is intended to be used for efficiency testing at pump test facilities or laboratories only. Industry experience shows that it is very difficult to perform measurements accurate enough to satisfy the requirements in this standard when testing is performed in the field. Therefore field-testing is not permitted as a method of efficiency testing per this standard.

A pump consists of either a bare pump along, a bare pump with driver and mechanical equipment, or a bare pump with driver, mechanical equipment, and controls.

This standard applies to a pump without fittings unless these fittings are an integral part of the pump, in which case, the losses for these components must be included with the performance of the pump.

This standard is not intended for production pump testing. Refer to ANSI/HI 14.6 *Rotodynamic Pumps for Hydraulic Performance Acceptance Tests* and ANSI/HI 11.6 *Rotodynamic Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical, and Electrical Acceptance Tests* for production pump testing.

40.6.1.1 Introduction

HI 40.6-2014 *Methods for Rotodynamic Pump Efficiency Testing* was developed as a normative standard for the testing of rotodynamic pump efficiency. HI 40.6 is derived from ANSI/HI 14.6, extracting that material that pertains specifically to the determination of the efficiency of a rotodynamic pump with no criteria for acceptance.

While the DOE has drafted and published pump efficiency testing regulations fundamentally based on HI 40.6-2014, there are some differences between HI 40.6-2014 to the test procedure (TP) final rule, as published by the DOE in the US *Federal Register* (DOE TP final rule). (81 FR 4085 [Jan. 25, 2016].) The HI 40.6 committee has identified these differences and has produced an updated version of the standard, HI 40.6-2016, that is believed to be in conformance with the DOE TP final rule.

This updated standard provided to the public is not considered an alternative efficiency determination method (AEDM) by the DOE. The Hydraulic Institute is providing this standard as a convenience at the request of interested parties. Manufacturers should consult the adopted regulatory text of 10 CFR 431 subpart Y to determine compliance.

In response to the DOE Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) a working group was established in February 2016 to develop an energy conservation standard for circulator pumps. This group was comprised of manufacturers, energy advocates, trade associations and other interested parties. The working group reached a consensus in December 2016 and concluded. At the time of this publishing the DOE has taken no formal action to implement the recommendation. The HI 41.5 Program Guideline for the Circulator Pump Energy Rating Program established a testing methodology for manufacturers to follow that aligned with the recommendation of the Circulator Pump Working Group. HI 40.6-2021 includes the applicable exemptions and modifications to the test procedure. See Appendix E.

[1] This document contains the test protocol for determining measured pump performance characteristics. The DOE test procedure for pumps (10 CFR 431.464) contains additional analysis and calculations necessary to determine the constant load or variable load pump energy index (PEI_{CL} or PEI_{VL}).