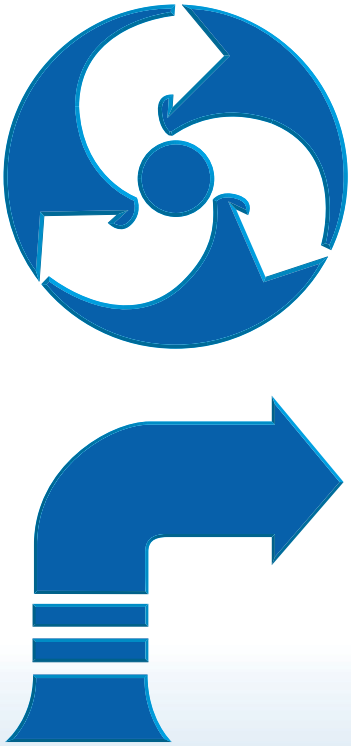

Hydraulic Institute Standard for

Methods for Rotodynamic Pump Efficiency Testing

HI 40.6-2014

Hydraulic Institute
INSTITUTE

6 Campus Drive
First Floor North
Parsippany, New Jersey
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Foreword (Not part of Standard)

HI 40.6 *Methods for Rotodynamic Pump Efficiency Testing* was developed as a normative standard for the testing of rotodynamic pump efficiency. This standard is in harmony with ANSI/HI 14.6-2011 *Rotodynamic Pumps for Hydraulic Performance Acceptance Tests* and ISO 9906-2012 *Rotodynamic pumps – Hydraulic performance acceptance tests – Grades 1, 2 and 3.* Efficiency testing is performed in accordance with grade 2.

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.

Purpose and aims of the Hydraulic Institute

The purpose and aims of the Institute are to promote the continued growth and well-being of pump users and pump manufacturers and further the interests of the public in such matters as are involved in manufacturing, engineering, distribution, safety, transportation, and other problems of the industry, and to this end, among other things:

a) To develop and publish standards for pumps;

b) To collect and disseminate information of value to its members and to the public;

c) To appear for its members before governmental departments and agencies and other bodies in regard to matters affecting the industry;

d) To increase the amount and to improve the quality of pump service to the public;

e) To support educational and research activities;

f) To promote the business interests of its members but not to engage in business of the kind ordinarily carried on for profit or to perform particular services for its members or individual persons as distinguished from activities to improve the business conditions and lawful interests of all of its members.

Purpose of Standards

1) Hydraulic Institute Standards 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.

2) Use of Hydraulic Institute Standards is completely voluntary. 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.”

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 sent to the Technical Director of the Hydraulic Institute. The inquiry will then be directed to the appropriate technical committee for provision of a suitable answer.

If a dispute arises regarding the contents of an Institute Standard or an answer provided by the Institute to a question such as indicated above, the point in question shall be sent in writing to the Technical Director of the Hydraulic Institute, who shall initiate the Appeals Process.

Units of measurement

Metric units of measurement are used, and corresponding US customary units appear in brackets. Charts, graphs, and sample calculations are also shown in both metric and US customary units. Since 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

This Hydraulic Institute Standard was produced and approved by a working committee that met many times to facilitate its development. At the time the standard was approved, the committee had the following members:

Co-Chair – Paul Ruzicka, Xylem Inc. – Applied Water Systems
Co-Chair – Arnie Sdano, Pentair Fairbanks Nijhuis

Committee Members	Company
Charles Cappellino	ITT – Industrial Process
Jack Claxton	Patterson Pump Company
Michael Coussens	Peerless Pump Company
Michael Mueller	Flowserve Corporation
Ares Panagoulias	Hydro, Inc.

Special Acknowledgement

Sarah Widder	Pacific Northwest National Laboratory

40.6 Methods for rotodynamic pump efficiency testing

40.6.1 Scope

This standard covers testing of rotodynamic pumps, up to 150 kW (200 hp), hereafter in this document referred to as *pumps*, establishing minimum testing protocols for verification of pump efficiency conforming to US Department of Energy (DOE) regulations.

HI 40.6 is intended to be used for efficiency testing at accredited pump test facilities, such as manufacturers' 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.

This standard applies to a bare pump by itself without any fittings, unless fittings are an integral part of the pump. In that case, the losses for these components must be included in the performance of the pump. A bare pump is defined as a rotodynamic machine constructed with fluid inlet and outlet sections and input shaft to drive it. The exception is a vertically suspended pump where this includes only the bowl assembly. A fitting is an upstream or downstream component that is not integral to the construction 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.

40.6.2 Terms and definitions

40.6.2.1 Introduction

For the purposes of this standard, the quantities, definitions, symbols, and units given here apply.

Table 40.6.2.1 gives definitions of quantities used in this standard.

Table 40.6.2.2a gives an alphabetical list of symbols used, and Table 40.6.2.2b gives a list of subscripts.

In this standard all formulae are given in coherent metric units. For conversion of other units to metric units, see Appendix E.

Table 40.6.2.1 — List of quantities, terms, and definitions

Row	Quantity	Definition	Symbol	Dimension	Unit[a]
1	Mass	The inertial resistance of a body to acceleration. A quantitative measure of inertia.	m	M	kg (lbm)
2	Length	The measurement of something from end to end.	L	L	m (ft)
3	Acceleration due to gravity	The acceleration of a body due to the influence of the pull of gravity alone. It is sufficient to use a value of 9.81 m/s^2.	g	LT^{-2}	m/s^2 (ft/s^2)
4	Speed of rotation	Number of rotations per unit time. (Commonly referred to as *revolutions per minute, rpm*.)	n	T^{-1}	s^{-1} min^{-1} rpm
5	Density	Mass per unit volume.	ρ	ML^{-3}	kg/m^3 (lbm/ft^3)