



American National Standard
for

Rotodynamic Pumps

– Guideline for Dynamics of
Pumping Machinery

ANSI/HI 9.6.8-2014



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Rotodynamic Pumps
– Guideline for Dynamics of
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Foreword (Not part of Standard)

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 directed 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 contents of an Institute publication 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, to initiate the appeals process.

Revisions

The Standards 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 ANSI canvass procedure.

Units of measurement

Metric units of measurement are used and corresponding US customary units appear in brackets. Charts, graphs, and example 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 be stated in reference to this standard. If no such statement is provided, metric units shall govern.

Consensus for this standard was achieved by use of the canvass method

The following organizations, recognized as having an interest in the standardization of rotodynamic pumps, were contacted prior to the approval of this revision of the standard. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed standard to ANSI.

A.W. Chesterton Company	Patterson Pump Company
4B Engineering	Peerless Pump
Bechtel Power Corporation	Pentair - Fairbanks Nijhuis
Black & Veatch Corp.	Pump Design, Development, & Diagnostics
Brown & Caldwell	Sulzer Pumps US Inc.
DuPont	Suncor Energy
ekwestrel corp	The Gorman-Rupp Company
GIW Industries Inc.	WEG Electric Corp.
Healy Engineering, Inc	Weir Floway, Inc.
Hidrostal AG	Weir Minerals Hazleton, Inc.
J.A.S. Solutions Ltd.	Weir Minerals Lewis Pumps
John Anspach Consulting	Weir Minerals NA
Kemet Inc.	Xylem Inc. - Applied Water Systems
Las Vegas Valley Water District	Zan Kugler, P.E. LLC.

Committee List

Although this standard was processed and approved for submittal to ANSI by the Canvass Method, a working committee met many times to facilitate its development. At the time it was developed, the committee had the following members:

Chair – Jack Claxton, Patterson Pump Company
Vice-chair – Michael Cropper, Sulzer Pumps (US) Inc.

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John Anspach
Jack Claxton
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Xylem Inc. - Applied Water Systems
Sulzer Pumps Solutions Inc.
Pentair - Fairbanks Nijhuis
CDM Smith
Weir Floway, Inc.

Company

ITT - Industrial Process
Mechanical Solutions, Inc.
CDM Smith
Sulzer Pumps (US) Inc.
Weir Minerals North America
Mechanical Solutions, Inc.
Xylem Inc. - Applied Water Systems
National Pump Company

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9.6.8 Guideline for dynamics of pumping machinery

9.6.8.1 Introduction and scope

9.6.8.1.1 Introduction

This guideline describes and recommends the means to appropriately evaluate pumping machinery construction attributes and relevant site characteristics in order to determine the effects of dynamic performance on equipment life and reliability. It describes and recommends various levels of detailed evaluation and validation that are commensurate with the degree of equipment uncertainty and application risk.

Dynamic perturbations may result in the excitation of structural resonance in any installation. With the trend towards increasing use of variable speed drives within pumping systems, avoiding this excitation of structural resonance has become increasingly more difficult. It is therefore important to ensure that the potential problems caused by high vibration are properly addressed and mitigated during the design phase.

Further development of the analytical tools and techniques used to identify these issues has also dramatically increased. However, it is not always clear which tools are available and how to use them in various applications across various markets and diverse products.

Equally the range of preventive measures remains quite diverse, ranging from simple to complex. The associated expense can be small to relatively large when compared to the cost of the equipment. In all cases it is better to avoid a problem than to fix it after the fact.

This document provides guidance for the pump industry pertaining to these topics.

9.6.8.1.1.1 Documents provided to facilitate use of this guideline

A table and three figures are provided below to facilitate the use of this document. They include:

- A flowchart describing the workflow (Figure 9.6.8.1.1.1a)
- A flowchart that references applicable sections of the guideline (Figure 9.6.8.1.1.1b)
- A checklist to facilitate use of the guideline, as applicable (Figure 9.6.8.1.1.1c)
- Sample specifications for use by specifiers (Appendices E and F)

NOTE: These figures are intended to provide instruction on the use of this guideline and can be used to locate appropriate sections in the document. The charts are not a substitute for understanding the complete guideline document.

9.6.8.1.2 Scope

This document covers rotodynamic pumps, as referenced in the Hydraulic Institute Standards.

(Note: Figures 9.6.8.1.2a, 9.6.8.1.2b, and 9.6.8.1.2c are provided to facilitate the use of this document. For more information on pump types, refer to ANSI/HI 1.1–1.2 *Rotodynamic (Centrifugal) Pumps – Types and Nomenclature* and ANSI/HI 2.1–2.2 *Rotodynamic (Vertical) Pumps – Types and Nomenclature*.)

Evaluation scenarios include the following:

- New equipment prior to field installation
- Existing equipment condition assessment in the field