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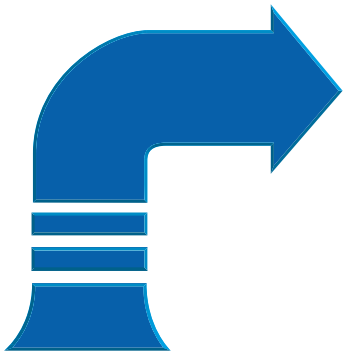

American National Standard for

Rotodynamic Vertical Pumps of Radial, Mixed, and Axial Flow Types

for Design and Application

Hydraulic INSTITUTE

6 Campus Drive
First Floor North
Parsippany, New Jersey
07054-4406
www.Pumps.org

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American National Standard

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Foreword (Not part of Standard)

Scope

The purpose and aims of the Institute are to promote the continued growth of pump knowledge for the interest of pump users and pump manufacturers and to 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, then the point in question shall be sent in writing to the Technical Director of the Hydraulic Institute, who shall 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 in accordance with the *ANSI Essential Requirements*.

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.

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

The following organizations, recognized as having an interest in the standardization of centrifugal 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.

4B Engineering & Consulting, LLC
A.W. Chesterton Company
Black & Veatch Corp.
Brown and Caldwell
Colfax Fluid Handling
ekwestrel corp
GIW Industries
Healy Engineering, Inc.
J.A.S. Solutions Ltd.
John Anspach Consulting
Kemet Inc.
Las Vegas Valley Water District
Patterson Pump Company
Pentair
Pump D^3, LLC
Weir Floway, Inc.
Weir Minerals Hazleton, Inc.
Weir Minerals North America
Xylem Inc.
Zan Kugler P.E., LLC

Committee List

Chair – Fred Walker, Weir Floway, Inc.
Vice-Chair – Michael Coussens, Peerless Pump Company

Committee Members	Company
Paul Behnke	ITT - Industrial Process
Daniel Boldt	Weir Floway, Inc.
James Bonifas	Nidec Motor Corporation
Randal Ferman	ekwestrel corp
Ralph Gabriel	John Crane Inc.
Al Iseppon	Pentair
Aleksander Roudnev	Weir Minerals North America
Paul Ruzicka	Xylem Inc. - Applied Water Systems
Joseph Salah	Sulzer Process Pumps (US) Inc.
Arnold Sdano	Fairbanks Nijhuis
Ernest Sturtz	CDM Smith
Bruce Ticknor III	National Pump Company

2.3 Design and application

The purpose of this standard is to provide a guide for the design and application of rotodynamic vertical pumps for various services. No attempt has been made to cover all phases of vertical pump design and application, but an endeavor has been made to point out some of the principal features of this type of pump and the precautions that should be taken in its use.

Rotodynamic pumps are kinetic machines in which energy is continuously imparted to the pumped liquid by means of a rotating impeller, propeller, or rotor. The most common types of rotodynamic pumps are radial, mixed, and axial flow, both in horizontal and vertical arrangements.

Vertical pumps offer flexibility of design that is not usually available with other pump types.

- The depth of the pump setting can be selected so that the net positive suction head available (NPSHA) exceeds the net positive suction head required (NPSHR) at all times.
- The pumping element is normally submerged (in a wet pit or can), which eliminates the need for priming devices, enhancing unattended reliable service.
- Minimum floor space is required.
- Many vertical pumps have characteristically steep head versus rate-of-flow curves. A steep head curve characteristic represents less rate-of-flow change with respect to head.
- In the range of intermediate specific speed (n_s [N_s]) designs, 50 - 100 (2500 - 5000), the maximum pump input power usually coincides with the recommended operating range and will not cause driver overload. Typical pump head and power characteristic curves are found in ANSI/HI 2.1-2.2 *Rotodynamic Vertical Pumps for Nomenclature and Definitions*.
- It is often possible to change the staging on the pump, i.e., adding to (or subtracting from) existing equipment or changing impellers in the pump.

2.3.1 Scope

This standard is for design and application of vertical turbine, mixed flow, axial flow vertical diffuser, submersible motor deepwell and short-set pumps, types VS0, VS1, VS2, VS3, VS6, VS7, and VS8 (Figure 2.3.1a) that are driven by vertical electric motors or horizontal engines with right-angle gears. Vertical overhung impeller pumps, types VS4 and VS5 (Figure 2.3.1b) are included in Appendix B. Excluded from the scope of this document are vertical in-line volute pumps and centrifugal volute pumps mounted vertically, such as sewage pumps.

2.3.1.1 Preferred units for pump applications

Preferred terms, units, and symbols to be used in the technology of pump applications are shown in Table 2.3.1.1.

2.3.1.2 Specific speed and suction specific speed

The user is cautioned to check carefully the basis of calculation of specific speed and suction specific speed before making any comparisons because there are subtle but significant differences in methods used throughout industry and in related textbooks and literature.