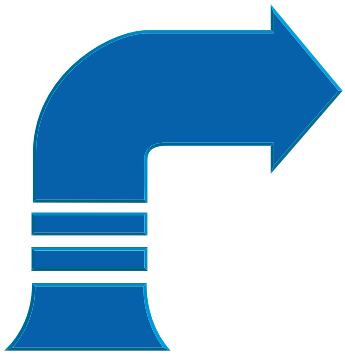

American National Standard for

# Rotodynamic Vertical Pumps

## of Radial, Mixed, and Axial Flow Types for Nomenclature and Definitions

*ANSI/HI 2.1–2.2-2014*

Hydraulic INSTITUTE

*6 Campus Drive*
*First Floor North*
*Parsippany, New Jersey*
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*www.Pumps.org*

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Sponsor
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**www.Pumps.org**

Approved April 8, 2014
**American National Standards Institute, Inc.**

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## Contents

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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 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 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.

### 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 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

Consensus for this standard was achieved by use of the canvass method. The following organizations, recognized as having interest in rotodynamic vertical pumps for nomenclature and definitions, 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
Bechtel Power Corporation
Black & Veatch Corp.
Brown and Caldwell
Colfax Fluid Handling
ekwestrel corp
Flowserve  Corporation
Healy Engineering, Inc.
John Anspach Consulting
Kemet Inc.
King County Wastewater Treatment Division
Las Vegas Valley Water District
National Pump Company
Patterson Pump Company
Peerless Pump Company
Pentair, Flow Technologies
Sulzer Pumps US Inc.
WEG Electric Corp.
Xylem Inc.
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:

*Co-Chair* - Michael L. Mueller, Flowserve Corporation
*Co-Chair* - Bruce Ticknor, III, National Pump Company

| **Committee Members** | **Company** |
|---|---|
| Michael S. Cropper | Sulzer Pumps (US) Inc. |
| Lucian Dobrot | TACO Inc. |
| Tiffany Hart (Alternate) | Sulzer Process Pumps (US) Inc. |
| Allen J. Hobratschk (Alternate) | National Pump Company |
| Al Iseppon | Pentair Water |
| Jim Roberts | Xylem Inc. - Applied Water Systems |
| Aleks Roudnev | Weir Minerals North America |
| Paul J. Ruzicka | Xylem Inc. - Applied Water Systems |
| Joe Salah | Sulzer Process Pumps (US) Inc. |
| Fred F. Walker | Weir Floway, Inc. |

**Preface**

Symbols are used throughout this standard to identify the pump types. The convention is to define the term in text, followed by the HI symbol in parenthesis (xx), and followed, when different, with the ISO symbol in brackets [xx].

ANSI/HI 2.3 *Rotodynamic Vertical Pumps of Radial, Mixed, and Axial Flow Types for Design and Application* complements the nomenclature and definitions content defined in this document with detailed information about the design and application of rotodynamic vertical pumps.

## 2 Rotodynamic vertical pumps

### 2.1 Types and nomenclature

#### 2.1.1 Scope

This standard is for types, nomenclature, and definitions of vertical turbine, mixed flow, axial flow vertical diffuser, submersible motor deep-well and short-set pumps, commonly defined as vertically suspended rotor types VS0, VS1, VS2, VS3, VS6, VS7, and VS8, as well as vertical overhung impeller types VS4 and VS5 (Figure 2.1.3) that are driven by vertical electric motors or horizontal engines with right-angle gears.

#### 2.1.2 Definition of rotodynamic vertical pumps

Rotodynamic vertical pumps are kinetic machines in which energy is continuously imparted to the pumped fluid by means of an impeller, propeller, or rotor having a vertical axis of rotation. The most common types of rotodynamic pumps are radial (centrifugal), mixed, and axial flow (propeller) pumps. Within these broad types there are many design variations in both horizontal axis and vertical axis configurations. A particular group of rotodynamic vertical pumps historically has been called *vertical turbine pumps*. The turbine pumps typically use radial, modified radial, or mixed flow impellers. (Refer to Sections 2.1.5.2 to 2.1.5.5.)

These pumps, particularly the radial flow and modified radial flow types, are usually designed for multistaging, by bolting or threading individual bowls together.

The pumping element (bowl assembly) is usually suspended by a column pipe, which also carries the liquid from the bowl (assembly) to the discharge opening.

Rotodynamic vertical pumps are normally classified as deep well, short set, or submersible motor-driven. The driver for these pump configurations is mounted either on the discharge head (line-shaft pumps); directly to the bowl assembly, either above or below (i.e., pumps with submersible motors); or in a horizontal configuration, such as an electrical motor or engine, driving through a right-angle gear.

#### 2.1.3 Types of vertical pumps

See Figures 2.1.3 to 2.1.3.6.

##### 2.1.3.1 Submersible – turbine bowl

This type of pump consists of an electric drive motor coupled directly to the bowl assembly. See Figure 2.1.3.1. The driving “submersible-type” motor and bowl assembly are designed to be submerged in the liquid pumped. The pumping element usually is of the turbine bowl design; however, mixed flow and propeller types are also available. This type of unit is normally used in wells and occasionally for wet pit or canned booster service. With this style pump the motor is fully submerged in the pumped liquid. A minimum velocity flow is required to cool the motor during operation. Where liquid temperatures exceed specified values, the motors must be derated according to manufacturers’ recommendations.