ANSI/HI 1.6-2000

American National Standard for

Centrifugal Pump Tests

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Approved October 27, 1999
American National Standards Institute, Inc.

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American National Standard

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Published By

Hydraulic Institute
9 Sylvan Way, Parsippany, NJ 07054-3802

www.pumps.org

Printed in the United States of America

ISBN 1-880952-30-0

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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 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 Hydraulic Institute. It will direct all such questions 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 referred to the Executive Committee of the Hydraulic Institute, which then shall act as a Board of Appeals.

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.

Scope

This Standard is for centrifugal, sealless centrifugal and regenerative turbine pumps of all industrial types except vertical multistage diffuser type. It includes detailed procedures on the setup and conduct of hydrostatic and performance tests of such pumps.

Several methodologies to test centrifugal and vertical pump equipment are available to pump manufacturers, users and other interested parties. The United States has two sets of pump test standards which represent two approaches to conducting and evaluating pump performance. One, promulgated by the American Society of Mechanical Engineers (ASME) and designated PTC 8.2, Centrifugal Pumps, provides for two levels of tests in which the test procedures are less restrictive. The ASME Code relies on the parties to the test to agree beforehand on the Scope and Conduct of the test and does not specify how the test results shall be used to compare with guarantee. The ASME is especially suited to highly detailed pump testing, whereas HI Standards detail test scope, conduct and acceptance criteria, and are thus suited to commercial test practices. ASME Codes do not permit the use of acceptability tolerances in reporting results, while the HI Standards do. It is recommended that the specifier of the test standard become familiar with both the ASME Code and the HI Standards before selecting the one best suited for the equipment to be tested, since there are a number of other differences between the two which may affect the accuracy or cost of the tests.

Both the ASME and HI Standards can be used for testing in either field or factory installations. The detailed requirements of the ASME Test Code are intended to reduce the effect of various installation arrangements on performance results and are applied more to field testing. The HI Standard specifies test piping and more controllable conditions which is more suitable to factory testing. The HI Standards do not address field testing. Surveys have shown that both ASME and HI Standards have been applied successfully to applications from small chemical pumps (1 hp) to large utility pumps (over 5000 hp).

Units of Measurement

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

Since values given in metric units are not exact equivalents to values given in US 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.

A.R. Wilfley & Sons
ANSIMAG Inc.
Bechtel Corp.
Black & Veatch
Brown & Caldwell
Camp Dresser & McKee, Inc.
Carver Pump Company
Cheng Fluid Systems, Inc.
Crane Company, Chempump Div.
Cuma S.A.
Dean Pump Div., Metpro Corp.
DeWante & Stowell
Dow Chemical
EnviroTech Pumpsystems
Essco Pump Division
Exeter Energy Ltd. Partnership
Fairbanks Morse Pump Corp.
Fluid Sealing Association
Franklin Electric
GKO Engineering
Grundfos Pumps Corp.
Illinois Dept. of Transportation
IMC - Agrico Chemical Corp.
Ingersoll-Dresser Pump Company
ITT Fluid Handling (B & G)
ITT Fluid Technology
ITT Industrial Pump Group
Iwaki Walchem Corp.
J.P. Messina Pump & Hydr. Cons.
John Crane, Inc.
Krebs Consulting Service
KSB, Inc.
M.W. Kellogg Company
Malcolm Pirnie, Inc.
Marine Machinery Association
Marley Pump Company
Marshall Engineered Products Company
Montana State University
MWI, Moving Water Industries
Oxy Chem
Pacer Pumps
Paco Pumps, Inc.
Pinellas Cty, Gen. Serv. Dept.
The Process Group, LLC
Raytheon Engineers & Constructors
Reddy-Buffaloes Pump, Inc.
Robert Bein, Wm. Frost & Assoc.
Scott Process Equipment Corp.
Settler Supply Company
Skidmore
South Florida Water Mgmt. Dist.
Sta-Rite Industries, Inc.
Sterling Fluid Systems (USA), Inc.
Stone & Webster Engineering Corp.
Sulzer Bingham Pumps, Inc.
Summers Engineering, Inc.
Systecon, Inc.
Val-Matic Valve & Mfg. Corp.
Yeomans Chicago Corp.
Zoeller Engineered Products

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1.6 Test

1.6.1 Scope

This standard is limited to the testing of centrifugal pumps with clear water. The tests conducted under these standards shall be made and reported by qualified personnel.

This standard only applies to tests of the pump unless stated otherwise.

The type of test(s) performed, and the auxiliary equipment to be used, should be agreed upon by the purchaser and manufacturer prior to the test.

It is not the intent of this standard to limit or restrict tests to only those described herein. Variations in test procedures may exist without violating the intent of this standard. *Exceptions may be taken if agreed upon by the parties involved without sacrificing the validity of the applicable parts of this standard.*

1.6.1.1 Objective

This standard is intended to provide uniform procedures for hydrostatic, hydraulic, and mechanical performance testing of centrifugal pumps and recording of the test results. This standard is intended to define test procedures which may be invoked by contractual agreement between a purchaser and manufacturer. It is not intended to define a manufacturer's standard practice.

1.6.2 Types of tests

This standard describes the following tests:

a) Performance test to demonstrate hydraulic and mechanical integrity;

Optional tests as follows when specified:

b) Hydrostatic test of pressure-containing components;

c) Net positive suction head required test (NPSHR test);

d) Mechanical test;

e) Priming time test.

For airborne sound testing see HI 9.1–9.5-2000, *Pumps – General Guidelines.*

1.6.2.1 Test conditions

Unless otherwise specified, the rate of flow, head, efficiency, NPSHR and priming time are based on shop tests using water corrected to 20°C (68°F). If the facility cannot test at rated speed because of limitations in power, electrical frequency or available speed changers, the pump may be tested at between 80% and 120% of rated speed. It is permissible on pumps greater than 225 kw (300 hp) to test at speeds between 60% and 140% of rated speed.

1.6.3 Terminology

The following terms are used to designate test parameters or are used in connection with pump testings:

1.6.3.1 Symbols

See Table 1.18.

1.6.3.2 Subscripts

See Table 1.19.

1.6.3.3 Specified condition point

Specified condition point is synonymous with rated condition point.

1.6.3.4 Rated condition point

Rated condition point applies to the rate of flow, head, speed, NPSH and power of the pump as specified by the purchase order.

1.6.3.5 Normal condition point

Normal condition point applies to the rate of flow, head, speed, NPSH and power at which the pump will normally operate. It may be the same as the rated condition point.

1.6.3.6 Best efficiency point (BEP)

The rate of flow and head at which the pump efficiency (η_p) is a maximum.

1.6.3.7 Shut off (SO)

The condition of zero flow where no liquid is flowing through the pump, but the pump is primed and operating.