



*American National Standard for*  
***Reciprocating  
 Pump Tests***

ANSI/HI 6.6-1994



9 Sylvan Way  
 Parsippany, New Jersey  
 07054-3802

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American National Standard for  
**Reciprocating Pump Tests**

Sponsor  
**Hydraulic Institute**

Approved August 22, 1994  
**American National Standards Institute, Inc.**

# American National Standard

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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 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 the 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 review, and revisions are undertaken whenever it is found necessary because of new developments and progress in the art.

## Scope

This Standard is for reciprocating power pumps, including controlled volume pumps, which are driven by power from an outside source applied to the crankshaft. It includes procedures for testing such pumps.

## Units of Measurement

US Customary units of measurement are predominantly used, and, where appropriate, Metric unit equivalents appear in brackets following the US units. Sample calculations are shown with US units only.

## Consensus for this standard was achieved by use of the Canvass Method

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

|                                                                         |                                         |
|-------------------------------------------------------------------------|-----------------------------------------|
| Agrico Chemical Corporation                                             | J. Brunner - Consultant                 |
| American Petroleum Institute                                            | John Crane, Inc.                        |
| Amer. Society of Heating, Refrigerating<br>& Air-Conditioning Engineers | Marine Spill Response Corporation       |
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| Hydraulic Institute                                                     | Union Carbide Chemicals & Plastics Co.  |
| Institute of Paper Science & Tech.                                      | US Bureau of Reclamation                |

## 6.6 Test

### 6.6.1 Scope

These standards apply to test of the pump only, unless stated otherwise.

The type of test 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 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 the standard.

#### 6.6.1.1 Objective

This standard provides uniform procedures for hydrostatic, hydraulic and mechanical pump performance testing and for recording of the test results of reciprocating pumps.

Vibration and acoustical testing methods are not included in this standard. Refer to Hydraulic Institute standards section on sound measurement for acoustical testing procedures.

### 6.6.2 Types of tests

This standard contains procedures for the following types of tests:

- a) Performance test to demonstrate one of the following:
  - 1) Mechanical integrity at speed and pressure specified;
  - 2) Capacity and mechanical integrity at speed and pressure specified;
  - 3) Capacity, power and mechanical integrity at speed and pressure specified.

And the following optional tests when specified:

- b) Hydrostatic testing of pressure-retaining components is described in Paragraph 6.6.8;
- c) Net positive suction head testing is described in Paragraph 6.6.9.

#### 6.6.2.1 Performance test

Unless otherwise specified, the capacity, pressure and efficiency are based on shop tests using water corrected to 68°F (20°C).

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 50% and 200% of rated speed.

### 6.6.3 Terminology

The following terms and symbols are used to designate test parameters used in connection with pump tests.

#### 6.6.3.1 Symbols

See Table 6.15 on next page.

#### 6.6.3.2 Subscripts

See Table 6.16 on page 3.

#### 6.6.3.3 Rated condition point

Rated condition point applies to the capacity, discharge pressure, suction pressure, NPSHR, speed and power of the pump as specified by the order.

#### 6.6.3.4 Normal condition point

Normal condition point applies to the point at which the pump will normally operate. It may be the same as the rated condition point.

#### 6.6.3.5 Volume (standard units)

The standard unit of volume shall be as follows:

- 1) US units – US gallon or cubic foot;
- 2) Metric – cubic meter.

The specific weight ( $\gamma$ ) of water at a temperature of 68°F shall be taken as 62.3 pounds per cubic foot. For other temperatures, proper specific weight corrections shall be made, using values from the ASME steam tables.

##### 6.6.3.5.1 Stroke (L)

The traverse of one complete unidirectional motion of the piston or plunger.

##### 6.6.3.5.2 Pump displacement (D)

The volume swept by all pistons or plungers per unit of time. Deduction for piston rod volume is made on double-acting piston type pumps.

For single-acting pumps, plunger or piston:

$$\text{(US units)} \quad D = \frac{ALnM}{231}$$

$$\text{(Metric)} \quad D = \frac{ALnM}{16.7 \times 10^6}$$