ANSI/AWWA **E103-21**

(Revision of ANSI/AWWA E103-15)

AWWA Standard

Horizontal Centrifugal and Vertical Line Shaft Pumps

Effective date: Apr. 1, 2022.
First edition approved by Board of Directors June 24, 2007.
This edition approved Oct. 25, 2021.
Approved by American National Standards Institute Sept. 28, 2021.

American Water Works Association

Approved American National Standard ANSI

STANDARD Since 1881

AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is defined by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. This standard does not supersede or take precedence over or displace any applicable law, regulation, or codes of any governmental authority. AWWA standards are intended to represent a consensus of the water industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed in the Official Notice section of *Journal AWWA.* The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether that person has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of ANSI approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036; 212.642.4900, or emailing info@ansi.org.

ISBN-13, print: 978-1-64717-0[illegible]-0

ISBN-13, electronic: 978-1-61300-613-9

DOI: http://dx.doi.org/10.12999/AWWA.E103.21

Committee Personnel

The AWWA Standards Committee on Horizontal and Vertical Line-Shaft Pumps, which reviewed and approved this standard, had the following personnel at the time of approval:

Pete Gaydon, *Chairman*

General Interest Members

E.P. Butts, 4B Engineering and Consulting, Salem, Ore.
P.F. Gaydon, Hydraulic Institute, Parsippany, N.J.
D. Kronebusch, McElhanney, Pentiction, B.C.
M. MacConnell (*liaison*), Standards Council Liaison, Metro Vancouver Water, Burnaby, B.C.
J.A. Hrdlicka (*liaison*), Standards Engineer Liaison, AWWA, Denver, Colo.
C.T. Michalos, CDM Smith, Colorado Springs, Colo.
C. Soni, Arcadis, Dallas, Tex.

Producer Members

M. Coussens, Peerless Pump Co., Indianapolis, Ind.
R.T. Gerstenberger, Gould Pumps/ITT, City of Industry, Calif.
P. Ruzicka, Xylem Inc., Seneca Falls, N.Y.
C. Zentic, Sulzer Pumps, Houston, Tex.

User Members

S. Ahmed, Great Lake Water Authority, Allen Park, Mich.
D. Carroll, Winter Park Ranch Water & Sanitation District, Fraser, Colo.
J. Heath, Denver Water, Denver, Colo.
D.M. Rausch, Aurora Water, Aurora, Colo.

This page intentionally blank.

Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

Tables

Foreword

This foreword is for information only and is not a part of ANSI/AWWA E103.*

I. Introduction.

I.A. *Background*. This standard describes the minimum requirements for horizontal centrifugal pumps and for vertical line-shaft pumps for installation in wells, water treatment plants, water transmission systems, and water distribution systems. Pumps described in this standard are intended for pumping freshwater at flow rates (at best efficiency point) ranging from 100 to 40,000 gpm (23 to 9,100 m^3/hr) at discharge pressures dictated by pump type and discharge conditions. This standard is applicable for driver power range from 10 to 1,500 hp (7 to 1,100 kW); however, this standard does not include requirements for drivers.

I.B. *History*. The original standard for vertical line-shaft turbine pumps presented the composite findings from studies conducted from 1949 to 1986 by committees consisting of manufacturers, consumers, and engineers. The first standard was published in 1955. In 1961, the standard was revised to include standards for submersible vertical turbine pumps. Additional technical changes were added in the 1971 revision. Solid shaft motors were added in the 1977 revision, together with numerous editorial changes and conversions to the international system of units. The 1977 standard was reaffirmed in 1982 without revision. Additional revisions were made in 1988.

In 1994, AWWA's Standards Council approved development of a new standard for horizontal centrifugal pumps. The new standard was assigned to AWWA Standards Committee 276 for Horizontal Centrifugal Pumps. Upon review of pump standards development in 1996, AWWA's Standards Council modified the development process to include two new pump standards to replace ANSI/AWWA E101-88, Vertical Turbine Pumps—Line Shaft and Submersible Types. As part of this action, two committees were renamed. AWWA Standards Committee 276 for Horizontal Centrifugal Pumps was changed to AWWA Standards Committee 276 for Horizontal and Vertical Line-Shaft Pumps. Committee 276 was charged with development of ANSI/AWWA E103, Horizontal and Vertical Line-Shaft Pumps. AWWA Standards Committee 375 for Vertical Turbine Pumps was changed to AWWA Standards Committee 375 for Submersible Vertical Turbine Pumps. Committee 375 was charged with development

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

of ANSI/AWWA E102, Submersible Vertical Turbine Pumps. During development of these two replacement standards, ANSI/AWWA E101-88 was withdrawn effective June 2000. The first edition of ANSI/AWWA E103 was approved by the AWWA Board of Directors on June 24, 2007. A revision to the 2007 edition was approved on June 7, 2015. This edition was approved on Oct. 25, 2021.

I.C. *Acceptance*. In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the Water Research Foundation* (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in or in contact with, drinking water rests with individual states.† Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. An advisory program formerly administered by USEPA, Office of Drinking Water, discontinued on Apr. 7, 1990.

2. Specific policies of the state or local agency.

3. Two standards developed under the direction of NSF‡: NSF/ANSI/CAN 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects, and NSF/ANSI 372, Drinking Water System Components—Lead Content.

4. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex*§ and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI/CAN 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdictions. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

* Water Research Foundation, 6666 West Quincy Avenue, Denver, CO 80235.

† Persons outside the United States should contact the appropriate authority having jurisdiction.

‡ NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

§ Both publications available from National Academy of Sciences, 500 Fifth Street, NW, Washington, DC 20001.

Annex A, "Toxicology Review and Evaluation Procedures," to NSF/ANSI/CAN 61 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an undefined list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA E103 does not address additive requirements. Users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additive requirements, including applicable standards.
2. Determine the status of certifications by parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

NSF/ANSI 372, Drinking Water System Components—Lead Content, lists restrictions for maximum lead content of materials in contact with drinking water. The user shall require NSF/ANSI 372 when applicable in the purchase documents. Currently compliance with NSF/ANSI 372 is mandatory in some states and meets the new low lead requirements of the U.S. Safe Drinking Water Act, which went into effect January 2014.

II. Special Issues.

II.A. *Chlorine and Chloramine Degradation of Elastomers*. The selection of materials is critical for water service and distribution piping in locations where there is a possibility that elastomers will be in contact with chlorine or chloramines. Documented research has shown that elastomers such as gaskets, seals, valve seats, and encapsulations may be degraded when exposed to chlorine or chloramines. The impact of degradation is a function of the type of elastomeric material, chemical concentration, contact surface area, elastomer cross section, environmental conditions, as well as temperature. Careful selection of and specifications for elastomeric materials and the specifics of their application for each water system component should be considered to provide long term usefulness and minimum degradation (swelling, loss of elasticity or softening) of the elastomer specified.

II.B. *Reliable Service.* Users of horizontal centrifugal and vertical line-shaft pumps should not expect long-lasting or reliable service unless all aspects of the pump application are defined: operating conditions, environmental conditions, and local ambient conditions. Additionally, the pump and driver unit, baseplate or mounting plate, foundation system, and connecting suction and discharge piping must be designed, installed, and aligned as an integrated system.

III. Use of This Standard.

It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the application being considered.

III.A. *Purchaser Options and Alternatives.* The following information should be provided in the purchase documents to further define the standard's requirements:

1. Standard used, ANSI/AWWA E103, Horizontal and Vertical Line-Shaft Pumps, latest revision.

2. Whether compliance with NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects, is required (Sec. 4.1.2, Sec. 4.5.3, and Sec. 4.5.3.1.2).

3. Details of other federal, state or provincial, and local requirements (Sec. 4.1.1).

4. Provide rate of flow, head, net positive suction head required (NPSHR), and speed of the pump (Section 3, #7).

5. If *NPSH3* is not required (Section 3 #22).

6. If materials of construction differ than Table A.1 (Sec. 4.2.3.3.1, Sec. 4.2.3.1).

7. If repair of structural defects is allowed (Sec. 4.2.4.6.7).

8. If replaceable wear rings are required with enclosed impellers (Sec. 4.2.4.8.3).

9. If replaceable wear rings of known galling resistant materials are required (Sec. 4.2.4.9.4).

10. If mechanical seal is required (Sec. 4.2.4.12).

11. If the pump is designed and constructed to operate in a flow range other than 70 to 120 percent of the flow at the BEP (Sec. 4.2.5).

12. If a wear plate on the suction side of the pump is required (Smaller pump sizes may not be able to accommodate a wear plate) (Sec. 4.3.1.12.1).

13. If pressurized lubrication systems are required (Sec. 4.4.1.5.3).

14. If keyed shafting is required (Sec. 4.4.2.2.1).

15. If the manufacture is to provide line shafting with hardened sleeves under bearings (Sec. 4.4.2.2.11).

16. If a bowl liner is required (Sec. 4.4.3.7.1).

17. If alternative designs (i.e., water-lubricated rubber bearings) are to be used (Sec. 4.4.3.10.2.4).

18. If surfaces not in contact with the water are not to be primed with one coat of paint to a minimum dry film thickness of 3 mil (Sec. 4.5.3.1).

19. What field top-coatings are required (Sec. 4.5.3.1.1).

20. If interior surfaces of pump casings are not to be coated with materials meeting the requirements of ANSI/AWWA C550 to a minimum dry film thickness of 8 mil (Sec. 4.5.3.2).

21. If the coated surfaces of the pump are holiday tested and are holiday free in accordance with ANSI/AWWA C550 (Sec. 4.5.5).

22. If the maximum vibration limits are not to be in accordance with ANSI/HI 9.6.4 (Sec. 4.6).

23. If the shipping preparation are to make the equipment suitable for six months of outdoor storage (Sec. 6.2.1.7).

24. If an affidavit of compliance is required (Sec. 6.3).

25. Required items in Section F.16, Information for Manufacturers.

IV. Modification to Standard. Any modification of the provisions, definitions, or terminology in this standard must be provided by the purchaser.

V. Major Revisions. Major changes made to the standard in this revision include the following:

1. Moved former Section II, Special Issues for Consideration, and former Sec. III, Information for Manufacturers, from the Foreword to new Appendix F.

2. Material requirements for pump components have been clarified (Sec. 4.1.3). Former Tables 1–4 of pump components and materials have been moved to Appendix A.

3. Dealloying corrosion and regulatory requirements have been clarified (Sec. 4.2.3).

4. Flange requirements have been updated and clarified (Sec. 4.2.4.7).

5. Impeller wear ring requirements have been updated (Sec. 4.2.4.9 and Sec. 4.3.1.11).

6. Forged elbows have been added to the discharge elbow section (Sec. 4.4.1.2).

7. Line shaft straightening requirements have been clarified (Sec. 4.4.2.2.6).

8. Impeller requirements have been updated (Sec. 4.4.3.5–4.4.3.7).

9. Outdoor storage requirements have been clarified in the packaging and shipping section (Sec. 6.2.1).

VI. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098, or email at standards@awwa.org.

This page intentionally blank.

ANSI/AWWA E103-21
(Revision of ANSI/AWWA E103-15)

American Water Works Association
Dedicated to the World's Most Important Resource®

AWWA Standard

Horizontal Centrifugal and Vertical Line Shaft Pumps

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard provides minimum requirements for horizontal centrifugal pumps and for vertical line-shaft pumps for installation in wells, water treatment plants, water transmission systems, and water distribution systems.

Sec. 1.2 Purpose

The purpose of this standard is to provide minimum requirements for water system pumps of the types identified in Sec. 1.1.

Sec. 1.3 Application

This standard can be referenced by the purchaser for pumps described in Sec. 1.1.

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, they form a part of this standard to the extent cited within the standard. In any case of conflict, the requirements of this standard shall prevail.