



**American Water Works
Association**

**ANSI/AWWA C223-02
(First Edition)**

The Authoritative Resource for Safe Drinking WaterSM

AWWA Standard

Fabricated Steel and Stainless Steel Tapping Sleeves



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6666 West Quincy Avenue
Denver, CO 80235-3098
T 800.926.7337
www.awwa.org

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AWWA Standard

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Committee Personnel

The Steel Water Pipe Manufacturers Technical Advisory Committee (SWPMTAC) Task Group for AWWA C223, which developed this standard, had the following personnel at the time:

Del H. Eaton, *Chair*

J.H. Burton, Brico Industries Inc., La Mirada, Calif.	(AWWA)
Ken Clark, Mueller Company, Decatur, Ill.	(AWWA)
R.R. Collins, JCM Industries Inc., Nash, Texas	(AWWA)
D.H. Eaton, Romac Industries Inc., Seattle, Wash.	(AWWA)
Z.J. Gentile, Ford Meter Box Company Inc., Pell City, Ala.	(AWWA)
Bill Kane, Cascade Waterworks Manufacturing Company, Yorkville, Ill.	(AWWA)
Stephen Lamb, Nickel Development Institute, Huntington, W. Va.	(AWWA)
Marvin Mintz, M-Square Associates Inc., Valley Stream, N.Y.	(AWWA)
R.N. Satyarthi, Baker Coupling Company Inc., Los Angeles, Calif.	(AWWA)
K.L. Shaddix, Smith-Blair Inc., Texarkana, Texas	(AWWA)
Martin Topps, Glenwed Pipe Systems, Hixson, Tenn.	(AWWA)

The AWWA Standards Committee on Steel Pipe, which reviewed and approved this standard, had the following personnel at the time of approval:

George J. Tupac, *Chair*

John H. Bambei Jr., *Vice-Chair*

Dennis Dechant, *Secretary*

Consumer Members

G.A. Andersen, New York City Bureau of Water Supply, Corona, N.Y.	(AWWA)
J.H. Bambei Jr., Denver Water, Denver, Colo.	(AWWA)
D.W. Coppes, Massachusetts Water Resources Authority, Chelsea, Mass.	(NEWWA)

R.V. Frisz, US Bureau of Reclamation, Denver, Colo.	(USBR)
T.R. Jervis, Greater Vancouver Regional District, Burnaby, B.C.	(AWWA)
T.J. Jordan, Metropolitan Water District of Southern California, La Verne, Calif.	(AWWA)
T.A. Larson, Tacoma Water Division, Tacoma, Wash.	(AWWA)
A.L. Linard, Los Angeles Department of Water & Power, Los Angeles, Calif.	(AWWA)
G.P. Stine, San Diego County Water Authority, San Diego, Calif.	(AWWA)
J.V. Young, City of Richmond, Richmond, B.C.	(AWWA)

General Interest Members

Ergun Bakall, Consultant, Tustin, Calif.	(AWWA)
W.R. Brunzell, Brunzell Associates Ltd., Skokie, Ill.	(AWWA)
R.L. Coffey, Kirkham Michael Consulting Engineers, Omaha, Neb.	(AWWA)
H.E. Dunham, Montgomery Watson Harza, Bellevue, Wash.	(AWWA)
K.G. Ferguson,* Montgomery Watson Harza, Las Vegas, Nev.	(AWWA)
S.N. Foellmi, Black & Veatch Corporation, Irvine, Calif.	(AWWA)
J.W. Green, Alvord Burdick & Howson, Lisle, Ill.	(AWWA)
K.D. Henrichsen, HDR Engineering Inc., Denver, Colo.	(AWWA)
M.B. Horsley,* Black & Veatch Corporation, Overland Park, Kan.	(AWWA)
J.K. Jeyapalan, Engineering Consultant, New Milford, Conn.	(AWWA)
Rafael Ortega, Lockwood Andrews & Newnam Inc., Houston, Texas	(AWWA)
A.E. Romer, Boyle Engineering Corporation, Newport Beach, Calif.	(AWWA)
H.R. Stoner, Consultant, North Plainfield, N.J.	(AWWA)
C.C. Sundberg, CH2M Hill Inc., Bellevue, Wash.	(AWWA)
G.J. Tupac, G.J. Tupac & Associates, Pittsburgh, Pa.	(AWWA)
J.S. Wailes,† Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)

* Alternate

† Liaison, nonvoting

L.W. Warren, Consultant, Seattle, Wash.	(AWWA)
W.R. Whidden, Post Buckley Schuh & Jernigan, Orlando, Fla.	(AWWA)

Producer Members

H.H. Bardakjian, Ameron Concrete & Steel Pipe, Rancho Cucamonga, Calif.	(AWWA)
R.J. Card, Brico Industries Inc., Atlanta, Ga.	(AWWA)
R.R. Carpenter, American Cast Iron Pipe Co., Birmingham, Ala.	(MSS)
Dennis Dechant, Northwest Pipe Company, Denver, Colo.	(AWWA)
J.E. Hagelskamp,* American Cast Iron Pipe Company, Birmingham, Ala.	(AWWA)
B.D. Keil, Continental Pipe Manufacturing Company, Pleasant Grove, Utah	(SPFA)
J.L. Luka,† American SpiralWeld Pipe Company, Columbia, S.C.	(AWWA)
Bruce Vanderploeg,† Northwest Pipe Company, Portland, Ore.	(AWWA)
J.A. Wise, Canus International Sales Inc., Maple Ridge, B.C.	(AWWA)

* Liaison, nonvoting

† Alternate

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Foreword

This foreword is for information only and is not part of AWWA Standard C223.

I. Introduction.

I.A. *Background.* Fabricated tapping sleeves are used to provide outlets on piping systems. They are made by several producers, and though details differ, all tapping sleeves provide similar features. They provide a means of attaching a tapping valve and tapping machine and a means of sealing onto or around the existing pipe.

I.B. *History.* This is the first edition of this standard.

This standard was prepared in response to requests from users of fabricated tapping sleeves for various pipe materials. It was approved by the Board of Directors on June 16, 2002.

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 all direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (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.

*Persons in Canada, Mexico, and non-North American countries should contact the appropriate authority having jurisdiction.

3. Two standards developed under the direction of NSF, ANSI^{*}/NSF[†] 60, Drinking Water Treatment Chemicals—Health Effects, and ANSI/NSF 61, Drinking Water System Components—Health Effects.

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 ANSI/NSF 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, “Toxicology Review and Evaluation Procedures,” to ANSI/NSF 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 unspecified 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.

AWWA C223-02 does not address additives requirements. Thus, users of this standard should consult the appropriate state or local agency having jurisdiction in order to

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

II. Special Issues. This standard has no applicable information for this section.

III. Use of This Standard. AWWA has no responsibility for the suitability or compatibility of the provisions of this standard to any intended application by any user. Accordingly, each user of this standard is responsible for determining that the standard’s provisions are suitable for and compatible with that user’s intended application.

^{*}American National Standards Institute, 25 W. 43rd St., Fourth Floor, New York, NY 10036.

[†]NSF International, 789 N. Dixboro Rd., Ann Arbor, MI 48105.

[‡]Both publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

III.A. *Purchaser Options and Alternatives.* The following items should be included in the purchaser's specifications:

1. Standard used—that is, AWWA C223, Standard for Fabricated Steel and Stainless Steel Tapping Sleeves, of latest revision.
2. Quantity.
3. Type of pipe(s), including specification to which it is made, or specification and tolerance of outside diameter.
4. Nominal Pipe Size(s).
5. Actual outside diameter (OD) of pipe including any coatings. (Sec. 3)
6. Wall thickness or class of pipe.
7. Type of service, i.e., line content; above or below ground, etc.
8. Rated pressure, transient pressure, and test pressure.
9. Operating temperature range.
10. Special requirements, such as coatings, gasket material, and bolting.
11. Flange specification, including dimensions for accommodating tapping valve fit-up.
12. Tapping sleeve and tapping sleeve flange material.
13. Inspection by the purchaser. (Sec. 5.1.2.)
14. Documentation requirements.
15. Requirements for test connections and postinstallation pressure testing.

Purchaser's Proof Test: The purchaser may specify individual hydrostatic proof testing. If individual hydrostatic proof testing is required, the assembled fabricated tapping sleeve shall be shop tested at a maximum of 1.5 times the rated pressure. The test shall be considered successful if no leakage is detected during one hour of sustained pressure at this level.

III.B. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided in the purchaser's specification.

IV. **Major Revisions.** This is the first edition of this standard.

V. **Comments.** If you have any comments or questions about this standard, please call the AWWA Volunteer & Technical Support Group, (303) 794-7711 ext. 6283, FAX (303) 795-7603, or write to the group at 6666 W. Quincy Ave., Denver, CO 80235.



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Fabricated Steel and Stainless Steel Tapping Sleeves

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes fabricated steel and stainless steel tapping sleeves used to provide outlets on pipe. They are intended for pipe sizes 4 in. (100 mm) through 48 in. (1,200 mm) with branch outlets through 36 in. (900 mm). This standard includes requirements for materials, dimensions, tolerances, finishes, and testing. This standard is not intended to apply to tapping sleeves welded to pipe. Fabricated tapping sleeves shall be manufactured from steel or stainless steel and are intended for use in systems conveying water. For outlets and main sizes greater than those specified, consult the manufacturer.

Sec. 1.2 Purpose

The purpose of this standard is to provide purchasers, manufacturers, and constructors with the minimum requirements for fabricated tapping sleeves for various pipe materials, including system components, testing, and marking requirements.

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Sec. 1.3 Application

This standard can be referenced in specifications for fabricated tapping sleeves. The stipulations of this standard apply when this document has been referenced and only to fabricated tapping sleeves.

SECTION 2: REFERENCES

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

ANSI/ASME B18.2.1—Square and Hex Bolts and Screws (Inch Series).

ANSI/ASME B18.2.3.7M—Metric Heavy Hex Structural Bolts.

ANSI/ASME B18.2.4.6M—Metric Heavy Hex Nuts.

ANSI/ASME B18.5—Bolts, Square Neck and Tee Head.

ANSI/ASME B18.5.2.1M—Bolts, Metric Round Head Short Square Neck.

ANSI/ASME B18.10—Track Bolt and Nuts.

ANSI/AWWA C111/A21.11—American National Standard for Rubber-Gasket Joints for Ductile-Iron and Pressure Pipe and Fittings.

ANSI/AWWA C200—Steel Water Pipe—6 In. (150 mm) and Larger.

ANSI/AWWA C207—Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).

ANSI/AWWA* C210—Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

ANSI/AWWA C213—Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

ANSI/AWWA C218—Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.

ANSI/AWWA C220—Stainless-Steel Pipe, 4 In. (100 mm) and Larger.

ANSI/AWWA C550—Protective Interior Coatings for Valves and Hydrants.

ASME† Boiler and Pressure Vessel Code, Section IX Welding and Brazing Qualifications.

*American Water Works Association, 6666 W. Quincy Ave., Denver, CO 80235.

†American Society of Mechanical Engineers, Three Park Ave., New York, NY 10016-5990.

ASTM* A36—Specification for Carbon Structural Steel.

ASTM A240—Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Purposes.

ASTM A262—Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels.

ASTM A276—Specification for Stainless Steel Bars and Shapes.

ASTM A283/A283M—Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

ASTM A307—Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength Cap.

ASTM A380—Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

ASTM A563—Specification for Carbon and Alloy Steel Nuts.

ASTM A563M—Specification for Carbon and Alloy Steel Nuts (Metric).

ASTM A743/A743M—Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

ASTM A744/A744M—Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.

ASTM A967—Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.

ASTM B573—Specification for Nickel-Molybdenum-Chromium-Iron Alloy (UNS N1003, N10242) Rod.

ASTM D395—Test Method for Rubber Property—Compression Set.

ASTM D412—Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers Tension.

ASTM D572—Test Method for Rubber Deterioration by Heat and Oxygen.

ASTM D1149—Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber.

ASTM D2000—Classification System for Rubber Products in Automotive Applications.

ASTM F568M—Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.

* American Society for Testing Materials, 100 Harbor Dr., W. Conshohocken, PA 19428-2959.

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ASTM F593—Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

ASTM F594—Specification for Stainless Steel Nuts.

ASTM F738M—Specification for Stainless Steel Metric Bolts, Screws, and Studs.

ASTM F836M—Specification for Style 1 Stainless Steel Metric Nuts.

AWS* A5.4—Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding.

AWS A5.9—Specification for Bare Stainless Steel Welding Electrodes and Rods.

AWS D1.1—Structural Welding Code—Steel.

AWS D1.6—Structural Welding Code for Stainless Steel.

AWWA Manual M11—Steel Pipe—A Guide for Design and Installation (1989).

MSS† SP-60-1991—Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Actual outside diameter.* The pipe outside diameter that is specified in the design. The diameter of the finished product may vary from the actual diameter by the specified tolerances and coating thickness. Whenever possible, it is recommended that a field measurement of the existing pipe be taken using a circumferential π tape. For larger tapping sleeves, with large-diameter tapping outlets, it is sometimes advisable to provide the manufacturer with a replication (template) of the pipe surface at the area of the tap.

2. *Bridging plate/armor.* A means of retaining mat-style gaskets between the sections of the fabricated tapping sleeve.

3. *Constructor.* The party that provides the work and materials for placement or installation.

*American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33135.

†Manufacturers Standardization Society of the Valve and Fittings Industry Inc., 127 Park St., NE, Vienna, VA 22180.

4. *Fabricated tapping sleeve.* An assembly used to provide outlet(s) on an existing pipe. See Figure 1.
5. *Gasket(s).* An elastomeric material that provides the pressure seal(s) of the fabricated tapping sleeve.
6. *Lay length.* The length of the tapping sleeve as measured from the centerline of the existing pipe to the face of the tapping flange.
7. *Manufacturer.* The party that manufactures, fabricates, or produces the materials or products.
8. *Nominal pipe size.* The commercial designation or dimension by which pipe is designated for simplicity. This may or may not be the same as the actual diameter.
9. *Outlet.* Also known as “branch.” Part of the fabricated tapping sleeve that connects to the tapping valve or other appurtenance.
10. *Purchaser.* The person, company, or organization that purchases any materials or work to be performed.
11. *Rated pressure.* Maximum sustained operating pressure under normal operating conditions.
12. *Tapping flange.* A flange attached to the fabricated tapping sleeve outlet that will accommodate the configuration of the tapping valve flange. See Figure 1.
13. *Transient pressure.* Surge or other pressures that exceed normal operating conditions and are of short duration.

SECTION 4: REQUIREMENTS

Sec. 4.1 Materials of Construction

4.1.1 *Fabricated tapping sleeve bodies.* Steel fabricated tapping sleeves shall be made from material that meets or exceeds the requirements of ANSI/AWWA C200. Stainless steel fabricated tapping sleeves shall be made from material that meets or exceeds the requirements of ANSI/AWWA C220. Other grades of material with equivalent or higher specified minimum yield strengths may be used provided they conform to a recognized international standard.

4.1.2 *Flanges.* Tapping flanges for steel fabricated sleeves shall meet or exceed the requirements of ANSI/AWWA C207. Tapping flanges for stainless steel fabricated tapping sleeves shall meet or exceed the requirements of ASTM A240, ASTM A743/A743M, or ASTM A744/A744M.

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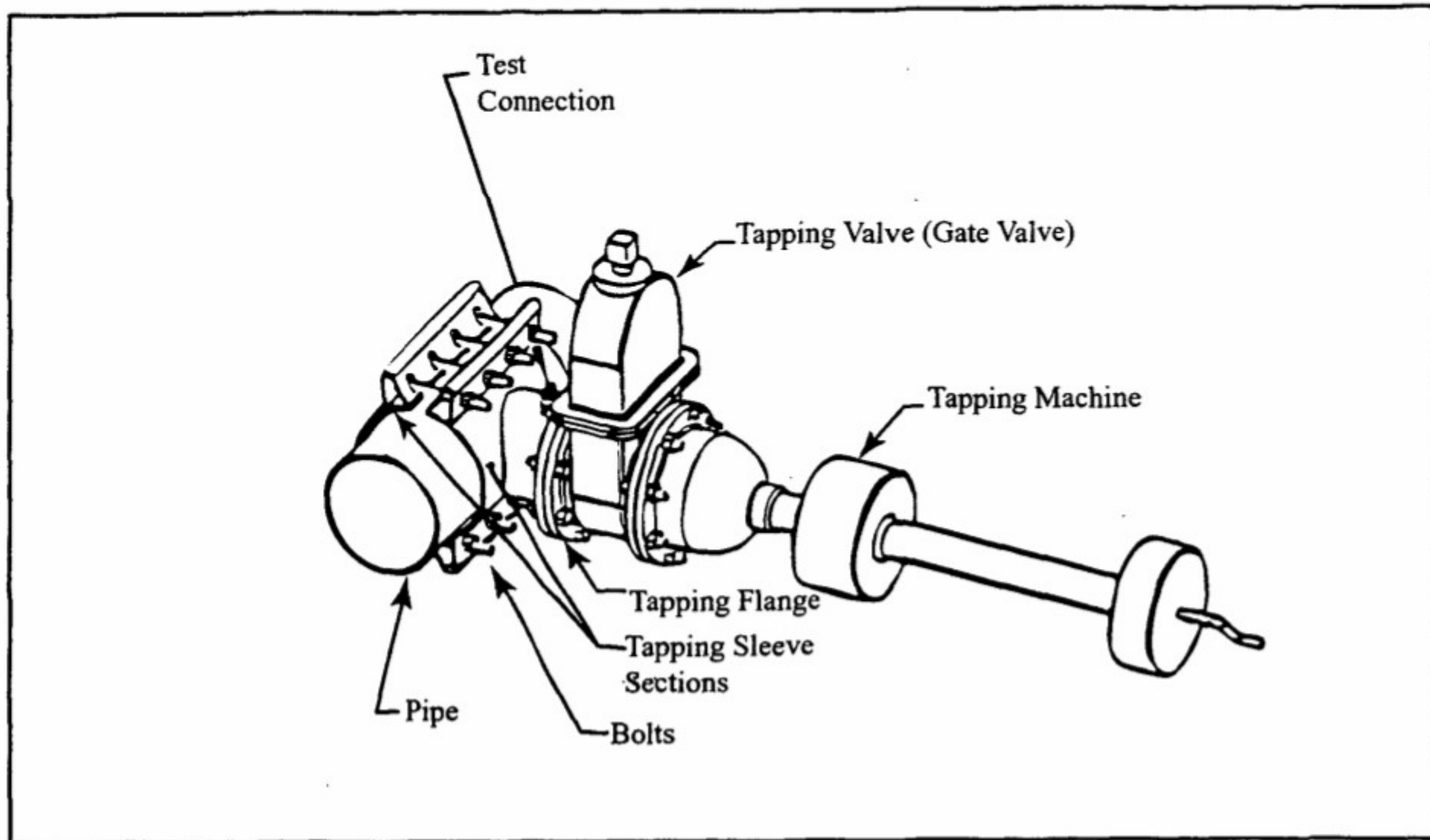


Figure 1 Typical fabricated tapping sleeve with valve and tapping machine

4.1.3 Gaskets.

4.1.3.1 Composition and physical requirements. Gaskets shall be molded or extruded natural or synthetic rubber free of porous areas and visible defects. Reclaimed rubber shall not be used. Unless otherwise specified, gaskets shall be suitable for water service to 150°F (65°C).

4.1.3.2 Gaskets for the body of the tapping sleeve shall meet the requirements of ASTM D2000 and have, as a minimum, physical properties sufficient to satisfy the design requirements of Sec. 4.2.3. Gaskets needed for the body of the tapping sleeve shall have a minimum durometer of 50 and minimum tensile strength of 800 psi. Gaskets for flanges shall conform to ANSI/AWWA C207.

4.1.3.3 Special service requirements. Where service conditions differ from those described in Sec. 1.1, special gasket material may be required. The purchaser shall specify these service conditions at the time of inquiry or order.

4.1.4 Bolting. Similar materials shall be used for bolts, nuts, and washers (when used) to minimize the possibility of galvanic corrosion. Advice from a qualified corrosion engineer is recommended.

Bolts shall meet or exceed the requirements of ASTM A307 or ASTM F568M for carbon steel or ASTM F593 or ASTM F738M for stainless steel. Nuts shall meet or exceed the requirements of ASTM A563 or ASTM A563M for carbon steel or ASTM F594 or ASTM F836M for stainless steel. Stainless steel bolts and nuts may gall, leading to improper gasket compression and leakage. When stainless steel bolting is used, application of an antiseize compound is recommended.

4.1.5 *Test connections.* A test connection shall be provided consisting of a welded $3/4$ -in. (19-mm) pipe coupling or as required by the purchaser.

Sec. 4.2 Design

4.2.1 *General.* The sections of the fabricated tapping sleeve shall be connected together on the pipe by the threaded fasteners. Tightening the fasteners compresses a gasket(s) against the fabricated tapping sleeve and pipe, thereby effecting a seal. This assembly allows the main to be tapped through the outlet, with or without interruption of service.

If required by the manufacturer, the purchaser shall provide design information, including actual pipe outside diameter, type of pipe, wall thickness, rated pressure, type of outlet connection required, and any other special requirements.

4.2.2 *Body thickness, flange gaskets, and flange class and drilling.* Body thickness for steel fabricated tapping sleeves shall meet or exceed the requirements of ANSI/AWWA C200. Body thickness for stainless steel fabricated tapping sleeves shall meet or exceed the requirements of ANSI/AWWA C220.

Flange class and drilling dimensions shall conform to the requirements of ANSI/AWWA C207, except that the inside diameter shall conform to the requirements of MSS SP-60 or as specified by the purchaser.

Flange gaskets shall conform to the dimensional requirements of ANSI/AWWA C207, except that the inside diameter shall be modified to accommodate a flange conforming to the requirements of MSS SP-60 or as specified by the purchaser.

4.2.3 *Fasteners.* The size, type, and number of fasteners shall be sufficient to exert a uniform force required to develop a gasket pressure that will effect a seal to the pressure requirements.

The manufacturer's recommended torque shall not result in the fasteners being tightened beyond the yield point of the fastener material.

4.2.3.1 Fasteners shall be headed or nonheaded rod, threaded as required. Bolt heads may be but not be limited to track head, carriage head, or hexagonal head.

Hexagonal heads shall be heavy hex in accordance with ANSI/ASME B18.2.1, B18.2.3.7M (metric). Carriage heads shall be in accordance with ANSI/ASME B18.5 or ANSI/ASME B18.5.2.1M. Track heads shall be in accordance with ANSI/ASME B18.10. Nuts shall conform to ANSI/ASME B18.2.2 or ANSI/ASME B18.2.4.6M.

4.2.3.2 Nuts and fasteners shall be threaded in accordance with ANSI/ASME B1.1, coarse thread series or coarse pitch metric threads defined in ANSI/ASME B1.13M.

Sec. 4.3 Fabrication

4.3.1 *General.* Fabrication of tapping sleeves shall conform to the general fabrication requirements in the following paragraphs. Each manufacturer shall be responsible for the quality of the welding done by its organization. Testing shall include but not be limited to test requirements listed in Sec. 5.3, Test Procedures.

4.3.2 *Welding.*

4.3.2.1 Welding procedure qualification. The procedure used in welding pressure-bearing parts and load-carrying nonpressure parts, such as clamping bolt lugs, to pressure parts shall be prequalified or qualified in accordance with AWS D1.1, AWS D1.6, or ANSI/ASME Section IX.

4.3.2.2 Welder qualification. The welders, welding equipment, and welding equipment operators used in welding pressure-bearing parts and in joining load-carrying nonpressure parts to pressure-bearing parts shall be qualified in accordance with AWS D1.1, AWS D1.6, or ASME Section IX.

4.3.2.3 Outlets. Each roll-formed outlet shall be welded with full-penetration welded butt joints after rolling. The welding procedure is to be qualified per Sec. 4.3.2.1. Outlets manufactured from pipe or tubing commercially produced to an accepted international standard do not require additional testing.

4.3.3 *In-process inspection.*

4.3.3.1 Visual inspection. All welds shall be visually inspected in accordance with AWS.

4.3.3.2 Defects. Defects, such as cracks, pinholes, incomplete fusion, and unacceptable weld profiles, shall be removed by mechanical means or by thermal gouging processes, after which the affected area shall be welded and inspected.

4.3.3.3 **Materials.** As fabrication progresses, all materials used in manufacturing shall be examined for imperfections that have become apparent during fabrication.

4.3.3.4 **Fabricated components.** All components shall be dimensionally examined to verify conformity to prescribed shape, design dimensions, and material thickness requirements after forming. Dimensional verification is to be performed at necessary stages of fabrication to ensure that all dimensional requirements have been met.

4.3.3.5 **Stainless steel weldments.** Sensitization (carbide precipitation) of welded components shall be determined per ASTM A262, Practice "A." No sign of unwanted carbide precipitation in the microstructure will be allowed. This procedure is not necessary if low carbon grades of stainless steel base metal and filler metal are used in welding.

Sec. 4.4 Coatings

4.4.1 *Standard shop coating.* All fabricated tapping sleeves shall receive an interior and exterior shop coating to inhibit rust during transit unless otherwise specified. This does not apply to fabricated tapping sleeves made of stainless steel.

4.4.2 *Coating.* Unless otherwise noted by the purchaser, all fabricated tapping sleeves shall receive interior and exterior coatings conforming to ANSI/AWWA C210, ANSI/AWWA C213, ANSI/AWWA C218, ANSI/AWWA C222, ANSI/AWWA C550, or other coatings agreed to by the purchaser and the manufacturer. The thickness of the lining and coating may be limited by the working tolerances of the tapping sleeve components. The purchaser shall consult the manufacturer to determine these limitations.

4.4.3 *Stainless steel tapping sleeves.* All stainless steel surfaces and weldments shall be descaled and passivated. Descaling and passivation shall be per ASTM A967 or per ASTM A380 Sec. 5.2, Chemical Descaling, or Sec. 5.3, Mechanical Descaling.

Sec. 4.5 Installation Instructions

The tapping sleeve shall be installed per the manufacturer's installation instructions provided with the fabricated tapping sleeve. The manufacturer's instructions must be followed regarding support of the valve and the tapping machine during tapping. Before tapping the pipe, it is recommended that the installer hydrostatically test the seal between the gasket and pipe. For personal safety

reasons, do not use a compressible fluid medium (such as air) to check for water tightness.

SECTION 5: VERIFICATION

Sec. 5.1 Inspection

5.1.1 *Inspection by the manufacturer.* The manufacturer shall establish quality control and inspection measures necessary to ensure compliance with this standard.

5.1.1.1 Dimensions. A gauging or measuring procedure shall be used to verify the dimensions of components to assure a proper fit.

5.1.2 *Inspection by the purchaser.* If the purchaser or their representative desires to inspect the fabricated tapping sleeve at the manufacturer's location, the purchaser shall so specify at the time of purchase request.

The purchaser shall have access to those parts of the manufacturer's facility that are necessary to ensure compliance with this standard. The manufacturer shall make available for the purchaser's use such gauges or measuring devices necessary for inspection. The manufacturer shall provide the purchaser with assistance, if necessary, in handling the items to be inspected.

Material certifications shall be made available to the purchaser on request. The extent of such certifications shall be indicated at time of purchase request. Materials shall comply with the requirements of Sec. 4.1, except as modified by the purchaser. Materials that do not comply may be rejected by the purchaser.

Sec. 5.2 Quality Assurance

The manufacturer shall maintain a quality assurance program to ensure that minimum standards are met.

Sec. 5.3 Test Procedures

5.3.1 *Testing.* Tests for proof of design may include but are not limited to hydrostatic testing and mechanical testing.

5.3.2 *Report.* The manufacturer, when requested by the purchaser, shall provide test data to verify that the proof of design hydrostatic testing has been accomplished.

Sec. 5.4 Rejection

Fabricated tapping sleeves that fail to meet the minimum provisions of this standard may be rejected by the purchaser. With agreement between the purchaser and manufacturer, rejected fabricated tapping sleeves may be repaired and retested or replaced.

SECTION 6: DELIVERY

Sec. 6.1 Marking

At the time of shipment from manufacturer, fabricated tapping sleeves shall be clearly marked with the following information:

1. Manufacturer's model number or type.
2. Pipe size(s) (outside diameter(s) of pipe).
3. Outlet size.

Sec. 6.2 Packing and Shipping

Care should be taken to properly protect fabricated tapping sleeve components from distortion or other damage during shipment.

Sec. 6.3 Certification of Compliance

The purchaser may require a certification from the manufacturer that the material provided according to the purchaser's specifications or purchase order complies with all applicable requirements of this standard.

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