

ANSI/AWWA **B451-23**  
(Revision of ANSI/AWWA B451-16)

AWWA Standard

**Poly  
(Diallyldimethylammonium  
Chloride)**

**Effective date: June 1, 2023.**

First edition approved by the Board of Directors June 14, 1987.

This edition approved Jan. 12, 2023.

Approved by American National Standards Institute Jan. 19, 2023.



American Water Works  
Association



## 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 specified 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 code 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 and 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 should 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 e-mailing [info@ansi.org](mailto:info@ansi.org).



ISBN-13, print: 978-1-64717-131-6

ISBN-13, electronic: 978-1-61300-665-8

DOI: <http://dx.doi.org/10.12999/AWWA.B451.23>

---

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including scanning, recording, or any information or retrieval system. Reproduction and commercial use of this material is prohibited, except with written permission from the publisher.

Copyright © 2023 by American Water Works Association  
Printed in USA

## Committee Personnel

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

David R. Purkiss, *Chair*

### *General Interest Members*

N. Edman (*liaison, nonvoting*), Standards Liaison, AWWA, Denver, Colo.

P.H. Hargette, Black & Veatch Corporation, Greenville, S.C.

D.R. Purkiss, NSF International, Ann Arbor, Mich.

S.H. Via (*liaison, nonvoting*), AWWA, Washington, D.C.

### *Producer Members*

B.S. Johnson, Industrial Specialty Chemicals, South Holland, Ill.

L.P. Robinson, Kemira Water Solutions Inc., Acworth, Ga.

### *User Members*

O.J. Dzydzora Sr., SUEZ, East Stroudsburg, Pa.

S. Garrison, Independent Consultant, Bellevue, Idaho

This page intentionally blank.

Currently in preview, click buy full version

# Contents

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

SEC.	PAGE	SEC.	PAGE
<b>Foreword</b>		4.3	Description ..... 4
I	Introduction..... vii	4.4	Qualifications..... 5
I.A	Background..... vii	4.5	Chemical and Physical Requirements..... 5
I.B	History..... viii	4.6	Impurities (Potable Water)..... 6
I.C	Acceptance (Water Supply Service Applications)..... ix	4.7	Additives Requirements (Potable Water)..... 6
I.D	Acceptance (Wastewater Service Applications)..... x	4.8	Impurities (Wastewater)..... 7
II	Special Issues..... x	4.9	Additives Requirements (Wastewater)..... 8
II.A	Safety..... x	4.10	Product Technical Data Sheet..... 8
II.B	Spill Control..... x	<b>5 Certification</b>	
III	Use of This Standard..... xi	5.1	General..... 11
III.A	Purchaser Options and Alternatives... xi	5.2	Sampling..... 11
III.B	Product Performance..... xii	5.3	Visual Inspection..... 11
III.C	Modification to Standard..... xii	5.4	Test Procedures..... 12
IV	Major Revisions..... xii	5.5	Inorganic Impurities..... 15
V	Comments..... xiii	5.6	Determining and Quantifying Residual DADMAC in PolyDADMAC Polymer Product..... 15
<b>Standard</b>		5.7	Determining PolyDADMAC Polymer..... 15
<b>1</b>	<b>General</b>	5.8	Notice of Nonconformance..... 16
1.1	Scope..... 1	5.9	Manufacturing Location Contact for Quality Control Inquiries .... 16
1.2	Purpose..... 1	<b>6 Delivery</b>	
1.3	Application..... 1	6.1	Marking..... 17
<b>2</b>	<b>References</b> ..... 2	6.2	Packaging and Shipping..... 17
<b>3</b>	<b>Definitions</b> ..... 2	6.3	Product Technical Data Sheets..... 18
<b>4</b>	<b>Requirements</b>		
4.1	Materials..... 3		
4.2	Product Certifications/Affidavit of Compliance..... 4		

This page intentionally blank.

Currently in preview, click buy full version

# Foreword

*This foreword is for information only and is not a part of ANSI/AWWA B451.*

## I. Introduction.

I.A. *Background.* Chemical clarification methods have been used to improve the quality of drinking water supplies since the late 1880s. In 1967, the first completely synthetic organic polyelectrolyte was accepted by the US Public Health Service for use in treating potable water. The responsibility for accepting additives for drinking water treatment was subsequently assumed by the US Environmental Protection Agency<sup>†</sup> (USEPA) and administered by its Office of Drinking Water as an advisory program. USEPA's acceptance was made by the specific name of the suppliers' product and not by generic type. Poly(diallyldimethylammonium chloride)<sup>‡</sup> (CAS<sup>§</sup> No. 76002-79-3) is one of several types of synthetic organic polyelectrolytes that were accepted for use in potable water treatment under this program, which was discontinued in 1990.

PolyDADMAC is an abbreviation for poly(diallyldimethylammonium chloride). PolyDADMAC is a family of synthetic cationic organic polyelectrolytes (also called *polymers* or *coagulants*) used in water and wastewater treatment to improve the performance of some unit operations in the treatment process, most often by increasing the extent or rate of liquid–solids separation. The DADMAC monomer used to make polyDADMAC is made from two chemicals: allyl chloride and dimethylamine (DMA). PolyDADMACs have a cationic charge, a high relative charge density, and low-to-medium relative molecular weights, and they are manufactured and sold primarily in the aqueous solution form, but the highest-molecular-weight versions may also be sold in the emulsion or powder forms. PolyDADMAC, which was first sold commercially around 1970, has been used to agglomerate particles in a wide variety of water (potable) and wastewater liquid–solids separation applications. A frequent application is clarification (removal of solid particles) or demulsification (removal of liquid organic particles). PolyDADMAC is also called *poly(diallyldimethylammonium chloride)*, *poly(dimethyldiallylammonium chloride)*, *polyDMDAAC*, *polyquaternary amine*, and *quaternized polyamine*. The important concepts to remember regarding polyDADMAC include the following:

\* American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036.

† Environmental Protection Agency, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460.

‡ Diallyldimethylammonium chloride is hereinafter abbreviated “DADMAC.” Poly(diallyldimethylammonium chloride) polymer is abbreviated “polyDADMAC.”

§ Chemical Abstracts Service, 2540 Olentangy River Road, P.O. Box 3012, Columbus, OH 43210.

1. PolyDADMACs in solution form are similar to EPI-DMA polyamines (ANSI/AWWA B452) in their use, handling, storage, and solution preparation.

2. PolyDADMACs in solution form are different from polyacrylamide (PAM) polymers (ANSI/AWWA B453) in their use, handling, storage, and solution preparation.

3. The following nomenclature is used to describe the forms in which polyDADMAC may be supplied:

- solutions (also called *aqueous solutions*, *liquids*, or *viscous solutions*);
- powders (also called *flake*, *dry*, *granular*, or *bead*); and
- emulsions (also called *liquids*, *dispersions*, or *inverse emulsions*).

4. PolyDADMAC is a family of polymers with a relatively constant charge type and constant charge density but with different molecular weights. They are essentially linear in structure, but the highest-molecular-weight versions may incorporate some branching.

5. The physical properties of polyDADMACs cannot be used to judge product performance; only laboratory testing, pilot-plant studies, or full-scale plant trials can discern product efficacy.

6. PolyDADMACs manufactured in solution form may contain inactive ingredients, such as sodium chloride, depending on the manufacturing method and formulation.

7. PolyDADMACs manufactured in emulsion form contain inactive petroleum solvents and surfactants and may also contain sodium chloride and other inactive ingredients, depending on the manufacturing method and formulation.

8. PolyDADMACs manufactured in powder form may contain sodium chloride and other inactive ingredients, depending on the manufacturing method and formulation.

The user should consult both the safety data sheet (SDS) and the product technical data sheet for the specific polyDADMAC product being used for information on the product's composition, physical properties, safety procedures, feeding and storage guidelines, and other important information. The supplier should provide copies of the product technical data sheet along with the SDS.

**I.E. History.** The AWWA Standards Council authorized the development of this standard in 1979. The standard was developed by the AWWA Standards Committee on Polyelectrolytes and was approved by the AWWA Board of Directors on June 14, 1987. Subsequent editions were approved on June 18, 1992; Jan. 25, 1998; June 13, 2004; June 20, 2010; and June 19, 2016. This edition of the standard was approved on Jan. 12, 2023.

I.C. *Acceptance (Water Supply Service Applications)*. In May 1985, 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). 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.<sup>¶</sup> 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 four standards developed under the direction of NSF<sup>\*\*</sup>: NSF/ANSI<sup>††</sup>/CAN<sup>‡‡</sup> 60, Drinking Water Treatment Chemicals—Health Effects; NSF/ANSI/CAN 61, Drinking Water System Components—Health Effects; NSF/ANSI/CAN 372, Drinking Water System Components—Lead Content; and NSF/ANSI/CAN 600, Health Effects Evaluation and Criteria for Chemicals in Drinking Water.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI/CAN 60. 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.

NSF/ANSI/CAN 600 (which formerly appeared in NSF/ANSI/CAN 60 and 61 as Annex A, “Toxicology Review and Evaluation Procedures”) 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 NSF/ANSI/CAN 600 procedures may not always be identical, depending on the certifier.

ANSI/AWWA B451 addresses additives requirements in Sec. 4.7 of the standard. The transfer of contaminants from chemicals to processed water or the residual solids is becoming a problem of greater concern. The language in Sec. 4.7 is a recommendation only for direct additives used in the treatment of potable water to be certified by

---

<sup>¶</sup> Persons outside the United States should contact the appropriate authority having jurisdiction.

<sup>\*\*</sup> NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

<sup>††</sup> American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

<sup>‡‡</sup> Standards Council of Canada, 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5 Canada.

an accredited certification organization in accordance with NSF/ANSI/CAN 60, Drinking Water Treatment Chemicals—Health Effects. However, users of the standard may opt to make this certification a requirement for the product. 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 parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

I.D. *Acceptance (Wastewater Service Applications)*. This is the first revision of ANSI/AWWA B451 that addresses wastewater service applications and standard.

## II. Special Issues.

II.A. *Safety*. PolyDADMACs manufactured in solution form are not considered to be toxic as household products nor are they considered primary skin or eye irritants by the Consumer Product Safety Commission (US Federal Hazardous Substances Act). Good housekeeping procedures and personal cleanliness are recommended when handling polyDADMAC. PolyDADMACs manufactured in emulsion form contain hydrocarbon solvents, the vapor of which can cause nausea, headaches, and other symptoms.

Safety glasses should be worn when handling solution or emulsion forms of polyDADMAC and, although not required, when handling the powder form. Appropriate first-aid practices should be followed in all cases of exposure. In case of eye contact, flush with plenty of water for at least 15 min and call a physician. Consult the SDS for the specific product for safety information and procedures before handling any polyDADMAC product or solution.

II.B. *Spill Control*. PolyDADMAC should be disposed of according to federal, state, local, and provincial regulations. Solutions of polyDADMACs make floors and other surfaces extremely slippery. A dike should be formed around the spill area to contain as much material as possible, and the contained material should be shoveled, scooped, or pumped, as appropriate, into suitable disposal containers. As much of any remaining material as possible should be removed by adsorbing it on vermiculite or other suitable adsorbing material and/or by wiping with adsorbing rags, as appropriate, and placed into suitable containers for disposal. Emulsion or powder forms of polyDADMAC will create very slippery solutions of polyDADMAC on contact with water. The spill area should be thoroughly hosed with warm water only after all possible polymer has been scooped up, adsorbed, or wiped up.

### 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 particular application being considered.

III.A. *Purchaser Options and Alternatives.* This AWWA standard can be used to prepare a purchase specification but is not itself a specification because it cannot address product requirements unique to the purchaser's specific application and does not establish business relationships. In addition, this polyDADMAC standard does not establish physical and chemical property specifications for any one polyDADMAC product because the physical and chemical properties of polyDADMACs do not always relate to their performance in specific applications.

Below are requirements that the user might consider when developing a polyDADMAC polymer product purchase specification. This standard requires the supplier to provide a product technical data sheet for each product in addition to an SDS and requires specific information to be included in the product technical data sheet. The information in a product technical data sheet may be used to establish or comply with purchase specifications.

1. Compliance with the latest revision of ANSI/AWWA B451, Poly(Diallyldimethylammonium Chloride), of latest revision, for potable water supply service applications (water) or wastewater service applications (wastewater), as applicable.
2. For potable water applications, compliance with NSF/ANSI/CAN 60, Drinking Water Treatment Chemicals—Health Effects, is required.
3. Description of application.
4. Estimated annual purchase requirements (pounds/kilograms).
5. Typical order quantity (number of containers and pounds/kilograms).
6. Shipping address (destination).
7. Special delivery requirements (need for truck with a lift gate; length and coupling sizes of hose needed for bulk delivery; transfer pump; allowed times of delivery; limitations on truck size or weight; sampling protocol; other). Are there any product physical property limitations such as a maximum viscosity that cannot be handled by the storage or feed equipment?
8. Order lead time (the number of days between order placement and delivery necessary if typical lead times are insufficient).
9. Billing addresses.
10. Financial terms.

11. Insurance/performance bond requirements.
12. Active polymer concentration in the product expressed as a weight percent.
13. Details of federal, state, provincial, territorial, and local requirements (Sec. 4.1).
14. Whether an affidavit of compliance is required for each shipment and lot (Sec. 4.2.3).
15. Specific physical and chemical properties for quality control. Minimum specifications should include visual inspection, total solids, Brookfield viscosity range, and pH of product's solution. Other important properties can be selected from the product technical data sheets of polyDADMAC products that have been shown to perform acceptably in the actual application or in laboratory jar tests. Verification of physical and chemical properties should be by the methods specified in Sec. 5 or by other methods acceptable to both the purchaser and supplier.
16. Sampling requirements (Sec. 5.2).
17. Requirement for supplier to provide manufacturing location contact information for quality control inquiries (Sec. 5.9).
18. Marking requirements (Sec. 6.1).
19. Whether the purchaser will reject product from containers or packaging with missing or damaged seals. The purchaser may reject product from bulk containers or packages with missing or damaged seals unless the purchaser's tests of representative samples, conducted in accordance with Sec. 5.2, demonstrate that the product meets the standard. Failure to meet the standard or the absence of, or irregularities in, seals may be sufficient cause to reject a shipment.
20. Whether alternative security measures have been adopted to replace or augment the security measures set out in Sec. 6.2.1 and Sec. 6.2.2.

III.B. *Product Performance.* Performance evaluation via a laboratory jar test or other performance test is essential for confirming polyDADMAC activity. Such a test is the only means of evaluating possible changes in the water composition, in the temperature, or in the type or amount of other chemicals added along with the polyDADMAC.

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

**IV. Major Revisions.** Major changes made in this revision of ANSI/AWWA B451 include the following:

1. Minor boilerplate language updates in the following sections:
  - I.C. Acceptance

- III.A. Purchaser Options and Alternatives
- 2: References
- 4.1 Materials
- 4.2 Product Certifications/Affidavit of Compliance
- 4.7 Additive Requirements (Potable Water)
- 4.8 Impurities (Wastewater)
- 5.6 Determining and Quantifying Residual DADMAC in PolyDADMAC Polymer Product
- 6.1 Marking
- 6.2 Packaging and Shipping

**V. Comments.** If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711; write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098; or email [standards@awwa.org](mailto:standards@awwa.org).

This page intentionally blank.



**American Water Works  
Association**

*Dedicated to the World's Most Important Resource®*

**ANSI/AWWA B451-23**  
(Revision of ANSI/AWWA B451-16)

**AWWA Standard**

---

# Poly(Diallyldimethylammonium Chloride)

---

## SECTION 1: GENERAL

---

### **Sec. 1.1 Scope**

This standard describes poly(diallyldimethylammonium chloride)\* for use in the treatment of potable water, wastewater, and reclaimed water.

### **Sec. 1.2 Purpose**

The purpose of this standard is to provide the minimum requirements for polyDADMAC products, including physical, chemical, packaging, shipping, and testing requirements, and to provide the means of developing requirements for specific polyDADMAC products.

### **Sec. 1.3 Application**

This standard can be referenced in documents for purchasing and receiving polyDADMAC and can be used as a guide for testing the physical and chemical properties of polyDADMAC samples. The stipulations for this standard apply when this document has been referenced and then only to polyDADMAC used in the treatment of potable water, wastewater, and reclaimed water. Each section or

---

\* Diallyldimethylammonium chloride is hereinafter abbreviated “DADMAC.” Poly(diallyldimethylammonium chloride) is abbreviated “polyDADMAC.”