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ANSI/AWWA B507-16
(First Edition)

AWWA Standard

Phosphoric Acid

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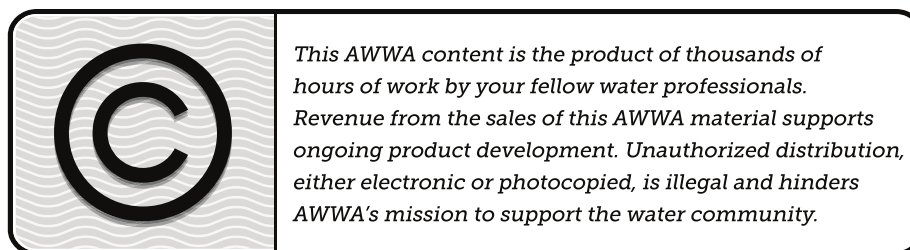
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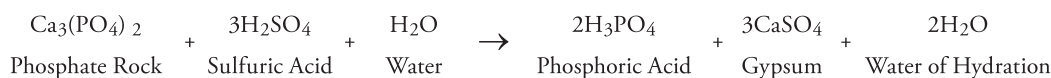
Foreword

This foreword is for information only and is not a part of ANSI/AWWA B507.*

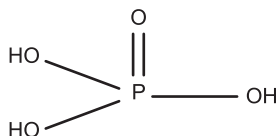
I. Introduction.

I.A. *Background.* Phosphate chemicals are among the few recognized chemical substances that can be safely and effectively used as a corrosion inhibitor in potable water. Several forms of phosphate inhibitors are available, one of which is phosphoric acid (H_3PO_4 , ortho-phosphoric acid, white phosphoric acid). Commercial- or technical-grade phosphoric acid is a manufactured product principally obtained by the addition of sulfuric acid to phosphate rock that is mostly mined in Florida, Tennessee, and the West in the United States. Food-grade phosphoric acid is generally produced by the electric-furnace method.

The reaction:



This typically produces a phosphoric acid concentration in the range of 28–32 percent with a pH of less than 1.5. Gypsum (CaSO_4) is precipitated and removed from solution leaving phosphoric acid, which has the molecular structure:



Pure anhydrous phosphoric acid is a white solid that melts at 42.35°C (108.23°F) to form a viscous liquid. The phosphoric acid concentration can either be diluted to 10 percent or less, or concentrated by evaporation to concentrations that generally range from 35 to 75 percent, up to 85 percent. The normal application concentration of phosphoric acid is 50 to 75 percent by weight in water.

Currently, there are over 25 chemical manufacturers and suppliers of phosphoric acid that have certification under NSF†/ANSI 60 Drinking Water Treatment Chemicals—Health Effects, and it is widely available throughout North America.

Its action as a corrosion inhibitor is often the reaction with the metal on the surface forming a metal phosphate film deposit as follows:

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

† NSF International, 789 Dixboro Road, Ann Arbor, MI 48105.

Metal	Chemical Formula	Mineral Name
Iron	$\text{Fe}_3(\text{PO}_4)_2$	Vivianite
Copper	$\text{Cu}_3(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$	Cupric orthophosphate
Lead	$\text{Pb}_5(\text{PO}_4)_3 \cdot \text{OH}$	Hydroxypyromorphite

The metal phosphate film can also have calcium and/or magnesium phosphate precipitates.

Typically, these films are not absolute barriers to corrosion but frequently can reduce corrosion and metal release rates significantly by reducing metal solubility.

The NSF/ANSI 60–certified maximum concentrations are a function of the phosphoric acid solution concentration.

Acid Concentration	Maximum H_3PO_4 Dosage
30–35%	25–27 mg/L
50% $\pm$ 5%	17 mg/L
70–75%	13–14 mg/L
80–85%	12 mg/L

These maximum acid feed concentrations translate to a maximum phosphorus (P) dosage of approximately 3 mg/L. That is the maximum concentration that is common, and the minimum effective dose can be as low as 0.15 mg/L P.

It is often necessary to initiate a phosphate corrosion control dosage at relatively high concentrations (e.g., 2 to 3 mg/L as P) to form an initial passivation film in the first month of application, then to decrease the feed in stages of about 25 percent of the maximum in sequential stages every two weeks to a maintenance dosage more in the order of 0.5 to 1 mg/L P.

The maintenance dosage may need to be increased during warmer water temperatures of summer and decreased in the cooler water temperatures of winter by as much as a 2:1 factor.

The corrosion rate may be measured and the phosphate dosage increased or decreased by insertion and periodic testing of metal coupons and/or metal release. Linear polarization probes are available for continuous real-time measurement of corrosion rates. Adjusting inhibitor dosage rates is system specific as there is a wide variation between corrosion rate and metal release.

I.B. *History.* This first edition of ANSI/AWWA B507, Standard for Phosphoric Acid, was approved by the AWWA Board of Directors on Jan. 16, 2016.