# INTERNATIONAL STANDARD ISO 3111

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# Copper alloys — Determination of tin as alloying element — Volumetric method

*Alliages de cuivre — Dosage de l'étain comme élément d'alliage — Méthode volumétrique*

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## FOREWORD

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International Standard ISO 3111 was drawn up by Technical Committee ISO/TC 26, *Copper and copper alloys,* and circulated to the Member Bodies in April 1973.

It has been approved by the Member Bodies of the following countries :

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No Member Body expressed disapproval of the document.

# Copper alloys – Determination of tin as alloying element – Volumetric method

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a volumetric method for the determination of tin in copper alloys.

The method is applicable for the determination of tin as an alloying element in all types of copper alloys listed in ISO Recommendations or International Standards.

## 2 PRINCIPLE

Separation of tin from the copper by co-precipitation with iron(III) hydroxide and titration with iodine solution in a carbon dioxide atmosphere after reduction with hypophosphorous acid.

## 3 REAGENTS

All the reagents shall be of analytical grade. Distilled or deionized water shall be used.

**3.1 Hydrochloric acid** ($\rho$ 1,09 g/ml).

Dilute 100 ml of hydrochloric acid ($\rho$ 1,19 g/ml) with 100 ml of water.

**3.2 Hydrogen peroxide,** 30 % (*m/m*) solution.

**3.3 Iron(III) chloride solution.**

Dissolve 10 g of iron(III) chloride ($FeCl_3 \cdot 6H_2O$) in water and dilute to 1 000 ml.

**3.4 Ammonia solution** ($\rho$ 0,945 g/ml).

Dilute 100 ml of ammonia solution ($\rho$ 0,89 g/ml) with 100 ml of water.

**3.5 Washing solution.**

Dissolve 10 g of ammonium chloride in water, add 50 ml of ammonia solution (3.4) and dilute with water to 1 000 ml.

**3.6 Mercury(II) chloride solution.**

Dissolve 0,5 g of mercury(II) chloride ($HgCl_2$) in 100 ml of water.

**3.7 Hypophosphorous acid solution.**

Dilute 600 ml of hypophosphorous acid ($H_3PO_2$), 50 %, to 1 000 ml with water.

**3.8 Ammonium thiocyanate solution.**

Dissolve 50 g of ammonium thiocyanate ($NH_4CNS$) in 100 ml of water.

**3.9 Potassium iodide solution.**

Dissolve 10 g of potassium iodide (KI) in 100 ml of water.

**3.10 Starch solution.**

Dissolve 0,5 g of starch in 100 ml of water.

Prepare freshly every 2 days.

**3.11 Potassium iodate solution.**

Dissolve 0,85 g of sodium hydroxide (NaOH) in 500 ml of water, add 3,0051 g of potassium iodate ($KIO_3$) and 12 g of potassium iodide (KI) and after dissolving in a 1 000 ml volumetric flask dilute to the mark (1 ml is equivalent to 0,005 g of tin).

**3.12 Potassium iodate solution.**

Transfer 200,0 ml of potassium iodate solution (3.11) into a 500 ml volumetric flask and dilute to the mark (1 ml is equivalent to 0,002 g of tin).

The tin equivalent of the solution (3.11) and solution (3.12) is determined by the analysis of a known amount of pure tin (corresponding to 1 %, 5 % or 10 % tin respectively) in the presence of a complementary quantity of copper (99 %, 95 % or 90 % respectively). The rules given in clause 6 shall be followed during this calibration.

## 4 APPARATUS

**4.1 Normal laboratory apparatus.**