

**AWS A4.4M:2001 (R2006)**  
**An American National Standard**



**Standard Procedures  
for Determination of  
Moisture Content of  
Welding Fluxes and  
Welding Electrode  
Flux Coverings**



**American Welding Society**



**Key Words**—Moisture, electrode covering, flux, infrared, Karl Fisher titration, combustion

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# **Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings**

Prepared by the  
American Welding Society (AWS) A5 Committee on Filler Metals and Allied Materials

Under the Direction of the  
AWS Technical Activities Committee

Approved by the  
AWS Board of Directors

## **Abstract**

This document establishes standard procedures for determination of moisture content of welding fluxes and welding electrode coverings. The test involves combustion of a sample in an oxygen carrier gas at elevated temperature. Any water evolved from the sample or formed by the combustion process is measured by means of either Karl Fischer titration or infrared detection. The key differences between these methods and traditional thermo gravimetric techniques are the inclusion of instrument calibration procedures, system verification checks and use of more accurate analytical techniques for water detection.



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# Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings

## 1. Scope

This standard describes methods for sample preparation and analysis for determination of total moisture content and other sources of hydrogen measured as water from welding fluxes and electrode coverings. The methods of analysis are suitable for shielded metal arc electrode coverings and submerged arc fluxes.

It is not the intent of this standard directly herein to classify arc welding electrodes or fluxes as to the total water content measured. However, it is intended that this standard be used as the standard test method for classification purposes to be referenced in individual filler metal specifications prepared by the AWS Committee on Filler Metals and Allied Materials and its subcommittees.

In addition to its use for classification purposes, it is intended that this standard be used for quality conformance testing of arc welding electrodes and fluxes. It is recommended that this standard be used for development and reporting research results so that the results may be directly compared with results from other laboratories.

This standard does not purport to address the safety and health precautions, if any, associated with the use of these procedures prescribed in this standard. It is the responsibility of the user of these procedures to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## 2. Normative Reference

The following ASTM standard<sup>1</sup> is referenced in the mandatory section of this standard:

ASTM E 203, *Standard Test Method for Water Using Volumetric Karl Fischer Titration*

1. ASTM standards are published by the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

## 3. Units of Measure

At the present time, U.S. Customary Units of measurement are normally the primary units of AWS documents, including the standards and specifications prepared by the Committee on Filler Metals and Allied Materials. However, these units are awkward when dealing with measurements used for moisture determination, whereas the S.I. Units are not. Furthermore, the use of S.I. Units with the thermogravimetric method of moisture determination is widespread in the U.S. already. Therefore, the S.I. Units of measurement are chosen as the primary units of measurement for this standard. Only S.I. Units are in practice, used for measurements directly used in computing moisture content. The conversion to nominal or approximate U.S. Customary Units is shown in ( ) for information.

## 4. Sample Preparation, Handling, and Storage

All electrode coverings and fluxes shall be analyzed without conditioning<sup>2</sup> unless otherwise specified by the applicable welding or welding consumable standards. If conditioning is employed, that fact, along with the method used for conditioning, and the time and temperature involved in the conditioning, shall be noted on the test record.

**4.1 Electrode Coverings.** The sample for moisture determination shall comprise the covering from the center portion of at least three electrodes. The covering can be removed by bending the electrode, causing flaking of the covering from the core. Care shall be taken to handle the covering sample with clean residue-free gloves, clean

2. Conditioning is any drying treatment applied to the electrode, flux, or electrode covering sample before analysis.