

**AWS A5.01M/A5.01:2013
(ISO 14344:2010 MOD)
An American National Standard**

Welding Consumables— Procurement of Filler Metals and Fluxes



American Welding Society®



AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD)
An American National Standard

Approved by the
American National Standards Institute
September 17, 2013

Welding Consumables—Procurement
of Filler Materials and Fluxes

5th Edition

Supersedes AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD)

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 provides a means by which the information needed for the procurement of welding consumables to a filler metal specification can be stated clearly, concisely, and completely. It includes a method by which the heat, lot, testing, and certification requirements that are essential to so many of today's welding applications can be specified in the procurement document. This specification makes use of both U.S. Customary Units and the International System of Units (SI). Since these are not equivalent, each system must be used independently of the other.



American Welding Society®

ISBN-13: 978-0-87171-843-3
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This standard is subject to revision at any time by the AWS A5 Committee on Filler Metals and Allied Materials. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are required and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS A5 Committee on Filler Metals and Allied Materials and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS A5 Committee on Filler Metals and Allied Materials to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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Foreword

This foreword is not part of AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD), *Welding Consumables—Procurement of Filler Materials and Fluxes*, but is included for informational purposes only.

This AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD) standard is a modified adoption of International Standard ISO 14344:2010, *Welding Consumables—Procurement of Filler Materials and Fluxes*. This standard contains certain modifications due to national requirements and the particular needs of the existing AWS filler metal specifications. These technical deviations and additional information have been added directly to the clauses to which they refer. A list of modifications is given in Annex D.

In this edition, the various forms of fully metallic consumables have been combined into one definition. For clarity and simplicity, the “Identification” section has been removed and items incorporated into the “Terms and Definitions” and “Lot Classification” sections as necessary. The term “Production Schedule” has been defined. The 24 hour restriction was removed from the C3 lot classification for consistency with other lot classifications, and the phrase “for each lot shipped” was changed to “for each lot supplied” in several places. Substantive changes are shown in *Italic font*.

This document allows the use of both U.S. Customary Units and the International System of Units (SI). The choice of units shall be based on the referenced classification standard.

This document provides a method for specifying in the purchase order the information necessary for the procurement of welding filler metals to an AWS, ISO, or other applicable welding consumable specification. The current document is the fourth revision of the initial AWS document issued in 1978.

The initial version of this document, published in 1978, was the result of work by a task group appointed by the AWS Committee on Filler Metals. The 1993 revision was prepared by a permanent subcommittee (AWS Subcommittee on Filler Metal Procurement Guidelines) which has continued to review specifications in accordance with guidelines of the American National Standards Institute. The evolution took place as follows:

AWS A5.01-78	<i>Filler Metal Procurement Guidelines</i>
ANSI/AWS A5.01-87	<i>Filler Metal Procurement Guidelines</i>
ANSI/AWS A5.01-93	<i>Filler Metal Procurement Guidelines</i>
AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD)	<i>Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes</i>

Use of the method described in this document can aid in procuring the required welding materials. With it, the applicable details are completely described in the purchase order using standard terms, thereby avoiding delays caused by incomplete or incorrect filler metal descriptions and testing requirements.

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. AWS and ISO shall not be held responsible for identifying any or all such patent rights.

Comments and suggestions for the improvement of this specification are welcome. They should be sent to the Secretary, AWS A5 Committee on Filler Metals and Allied Materials, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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Welding Consumables—Procurement of Filler Materials and Fluxes

1 Scope

This standard identifies various information necessary for communication between a purchaser and a supplier of welding consumables. This standard, together with an AWS, ISO, or other recognized welding consumable standard, provides a method for preparing those specific details needed for welding consumable procurement which consist of the following:

- a) the welding consumable classification (selected from the pertinent AWS, ISO, or other applicable welding consumable standard);
- b) the lot class (selected from Clause 4 of this standard);
- c) the testing schedule (selected from Clause 5 of this standard).

Selection of the specific welding consumable classification, lot class and testing schedule will depend upon the requirements of the application for which the welding consumable is being procured.

2 Normative References

The following normative documents contain provisions which, through references in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest editions of the normative documents referred to apply. Members of ISO and IEC maintain registers of currently valid International Standards.

2.1 The following AWS standards¹ are referenced in the mandatory section of this document.

AWS A3.0 M/A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*

AWS A5.02/A5.02M, *Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes*

2.2 The following ASTM standard² is referenced in the mandatory section of this document:

ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

2.3 The following ISO standard³ is referenced in the mandatory section of this document.

ISO 544, *Welding Consumables — Technical Delivery Conditions for Welding Filler Materials — Type of Product, Dimensions, Tolerances and Markings*

¹ AWS standards are published by the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

² ASTM standards are published by ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

³ ISO standards are published by the International Organization for Standardization, 1 rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland.

3 Terms and Definitions

In production, the components of welding consumables shall be divided into discrete quantities so that satisfactory tests with a sample from that quantity will establish that the entire quantity meets specification requirements. These quantities, known by such terms as heats, lots, blends, batches, and mixes, vary in size according to the manufacturer. For identification purposes, each manufacturer assigns a unique designation to each quantity. This designation usually consists of a series of numbers or letters, or combinations thereof, which will enable the manufacturer to determine the date and time (or shift) of manufacture, the raw materials used, and the details of the procedures used in producing the welding consumable. This designation stays with the welding consumable and can be used to identify the material later, in those cases in which identification is necessary.

For the purposes of this standard, the following definitions describing discrete quantities of the components used in the manufacturing of welding consumables apply.

3.1 Dry Batch

The quantity of dry ingredients mixed at one time in one mixing vessel.

NOTE: Liquid(s), such as binders, when added to a dry batch, produce a wet mix. A dry batch may be divided into homogeneous smaller quantities, in which case addition of the liquid(s) produces a corresponding number of smaller wet mixes.

3.2 Dry Blend

Two or more dry batches from which quantities of each are combined proportionately, then mixed in a mixing vessel to produce a larger quantity in which the ingredients are as uniformly dispersed as they would have been had the entire quantity been mixed together at one time in one large mixer.

NOTE: A dry blend, as in the case of a dry batch, may be used singly or divided into smaller quantities, in which case addition of liquid(s) produces a corresponding number of smaller wet mixes.

3.3 Wet Mix

The combination of liquid(s) and a dry batch, dry blend, or a portion thereof, mixed at one time in one mixing vessel.

3.4 Heat

For fully metallic consumables, or the fully metallic rod, tube or strip used to fabricate tubular cored or covered electrodes the following apply. The specific definition is dependent on the method of melting and refining of the metal:

3.4.1 The material obtained from one furnace melt, where slag-metal or gas-metal reactions occur in producing the specified alloy (e.g., open hearth, electric arc, basic oxygen, argon-oxygen processes). Mill splicing of coils from different heats is not permitted, and coils containing transition heats may not be classified in this manner.

3.4.2 An uninterrupted series of melts from one controlled batch of metals and alloying ingredients in one melting furnace under the same melting conditions, each melt conforming to the chemical composition range approved by the purchaser of the material (i.e., the producer of the welding consumable) where significant chemical reactions do not occur in producing the specified alloy (e.g., induction melting in a controlled atmosphere or in a vacuum).

3.4.3 An uninterrupted series of remelts in one furnace under the same remelting conditions using one or more consumable electrodes produced from a single heat, each remelt conforming to the chemical composition range approved by the purchaser of the material (i.e., the producer of the welding consumable) in processes involving continuous melting and casting (e.g., consumable electrode remelt).

3.5 Controlled Chemical Composition

3.5.1 Covering or core ingredients consisting of one or more wet mixes, dry batches, or dry blends that are subjected to sufficient tests to assure that all within the lot are equivalent. These tests shall include chemical analysis, the results of which shall fall within the manufacturer's acceptance limits. The identification of the test procedure and the results of the tests shall be recorded.

3.5.2 Fully metallic consumables, or the fully metallic rod, tube, or strip used to fabricate tubular cored or covered electrodes that consist of mill coils of one or more heats from which samples have been taken for chemical analysis and validated as described in this clause. Mill coils from mills that do not permit spliced-coil practice need to be sampled only on one end. Coils from mills that permit spliced-coil practice with a maximum of one splice per coil need to be sampled on both ends. Coils with more than one splice are not permitted under this definition. The results of the analysis of each sample shall be recorded and be within the manufacturer's composition limits for that material.

3.6 Lot

A unique identifying designation for a specific type and quantity of welding consumable, usually beginning with the word "lot" and followed by a series of numbers and/or letters. The lot class, as identified in Clause 4, details the requirements for grouping consumables into a single lot.

3.7 Production Schedule

A manufacturing campaign of a single lot number produced by either a single manufacturing operation or a series of manufacturing operations, any part of which is uninterrupted by the production of any other product or any other lot number of the same product.

3.8 Certificate of Compliance

A statement that the product meets the requirements of the AWS, ISO, or other applicable welding consumable specification/classification.

A summary of results may be included and may be in the form of averages, ranges, or single representative values and is not necessarily from a single set of tests run at the same time, or even unique for a specific size.

3.9 Certificate of Conformance

A test report documenting that the product meets the requirements of the AWS, ISO, or other applicable welding consumable specification/classification.

The reported results shall be in the form of a single set of tests run at the same time, using representative material/product, and may be for a specific size (diameter) or for all sizes (diameters) required to be tested for classification. Actual test values for all tests required for the AWS, ISO, or other applicable welding consumable classification shall be reported and include a date showing when these actual tests were completed. The report shall not consist of averages, ranges, or single random or "representative" values. It is not usually specific to the actual material supplied.

The date when the test(s) were actually completed must be shown, but there is no requirement as to how recently they must have been completed (e.g., within 12 months of the date of the purchase order, etc.)

3.10 Certified Material Test Report (CMTR)

A test report where there is specific reference to the tests being conducted on the actual material supplied. The CMTR may contain results of some or all of the tests required for classification, or other tests as agreed upon by the purchaser and supplier. Several examples of what these may include follow.

- Chemical analysis only (per each heat or lot, for the size supplied)—Schedule 3 or H per AWS A5.01M/A5.01.
- Tests listed in Table 2 of AWS A5.01M (per each heat or lot, for the size supplied)—Schedule 4 or I per AWS A5.01M/A5.01.

- All tests required for classification per the applicable AWS or ISO specification (per each heat or lot, for the size supplied)—Schedule 5 or J per AWS A5.01M/A5.01.
- Any additional tests required by the purchaser (per each heat or lot, for the size supplied)—Schedule 6 or K per AWS A5.01M/A5.01.

3.11 Material Test Report (MTR)

A report documenting the results of tests performed by the manufacturer to fulfill the requirements of the material specification. Results of tests performed to meet supplementary or special requirements specified by the purchaser may also be included on the MTR. An MTR shall identify the applicable material specification and shall include unique identification linking it to the actual material supplied. A Certificate of Conformance, Certificate of Compliance, or “Typical” Test report are not considered acceptable replacements for, or equivalent to, an MTR. A CMTR is a certified copy of an MTR.

3.12 Typical Test Report (“Typical”)

A nonstandard term which does not have a consistent definition. See Certificate of Compliance or Certificate of Conformance.

4 Lot Class

A Lot Class is a two character designation consisting of a letter representing the form of the consumable and a number designating how the grouping of a quantity of consumables into a single lot is allowed. The lot class shall be selected by the purchaser from those listed below.

4.1 Fully Metallic Solid Consumables

4.1.1 Lot Class S1

The quantity of fully metallic solid welding consumables not exceeding the manufacturer’s standard lot, as defined in the manufacturer’s quality assurance program.

4.1.2 Lot Class S2

The quantity not exceeding 45 000 kg [100 000 lb] of one *fully metallic solid* welding consumable classification, size, form and temper produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts) from one heat as defined in 3.4 or from controlled chemical composition material as defined in 3.5.2.

4.1.3 Lot Class S3

The quantity of one *fully metallic solid* welding consumable classification and one size produced in one production schedule as defined in 3.7 from one heat as defined in 3.4.

4.1.4 Lot Class S4

The quantity not exceeding 45 000 kg [100 000 lb] of one *fully metallic solid* welding consumable classification, size, form, and temper produced under one production schedule as defined in 3.7 from one heat as defined in 3.4 or from controlled chemical composition material as defined in 3.5.2.

4.2 Tubular Cored Electrodes and Rods

4.2.1 Lot Class T1

The quantity of tubular welding consumable not exceeding the manufacturer’s standard lot, as defined in the manufacturer’s quality assurance program.

4.2.2 Lot Class T2

The quantity not exceeding 45 000 kg [100 000 lb] of one tubular welding consumable classification and size produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts) from rod, tube,

or strip from one heat as defined in 3.4 or by controlled chemical composition as defined in 3.5.2, and core ingredients from one dry batch as defined in 3.1 one dry blend as defined in 3.2, or controlled chemical composition as defined in 3.5.1.

4.2.3 Lot Class T3

The quantity of one tubular welding consumable classification and size produced from rod, tube, or strip from one heat as defined in 3.4, and core ingredients from one dry batch as defined in 3.1 or one dry blend as defined in 3.2.

4.2.4 Lot Class T4

The quantity not exceeding 45 000 kg [100 000 lb] of one tubular welding consumable classification and size produced under one production schedule as defined in 3.7 from rod, tube or strip from one heat as defined in 3.4 or by controlled chemical composition as defined in 3.5.2. and core ingredients from one dry batch as defined in 3.1, one dry blend as defined in 3.2, or controlled chemical composition as defined in 3.5.1.

4.3 Covered Electrodes

4.3.1 Lot Class C1

The quantity of covered electrodes not exceeding the manufacturer's standard lot, as defined in the manufacturer's quality assurance program.

4.3.2 Lot Class C2

The quantity not exceeding 45 000 kg [100 000 lb] of one covered electrode welding consumable classification and size produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts).

4.3.3 Lot Class C3

The quantity not exceeding 45 000 kg [100 000 lb] of one covered electrode welding consumable classification and size produced under one production schedule as defined in 3.7 from core wire from one heat as defined in 3.4 or controlled chemical composition as defined in 3.5.2, and covering ingredients from one wet mix as defined in 3.3 or controlled chemical composition as defined in 3.5.1.

4.3.4 Lot Class C4

The quantity of one covered electrode welding consumable classification and size produced from core wire from one heat as defined in 3.4 and covering ingredients from one wet mix as defined in 3.3.

4.3.5 Lot Class C5

The quantity of one covered electrode welding consumable classification and size produced from core wire from one heat as defined in 3.4 and covering ingredients as from one dry batch as defined in 3.1 or one dry blend as defined in 3.2.

4.4 Fluxes for Submerged Arc and Electroslag Welding

4.4.1 Lot Class F1

The quantity of flux not exceeding the manufacturer's standard lot, as defined in the manufacturer's quality assurance program.

4.4.2 Lot Class F2

The quantity of flux produced from the same combination of raw materials under one production schedule as defined in 3.7.

5 Level of Testing

5.1 Schedule 1 or F

The level of testing shall be the manufacturer's standard. A statement, "the product supplied will meet the requirements of the applicable AWS, ISO, or other applicable welding consumable standard when tested in accordance with that standard" and a summary of the typical properties of the material, when tested in that manner, shall be supplied upon written request.

5.2 Schedule 2 or G

Test results shall be supplied from any product manufactured within twelve months preceding the date of the purchase order. This shall include results of all tests required for that classification in the AWS, ISO, or other applicable welding consumable standard.

5.3 Schedule 3 or H

Chemical analysis of the *specific lot* of consumables shall be supplied. The analysis shall include those elements required for that classification in the AWS, ISO, or other applicable welding consumable standard.

5.4 Schedule 4 or I

Results of the tests called for in Table 2 *for the specific lot of consumables* shall be supplied. These tests represent a consensus of those frequently requested for consumables certification; however, they do not necessarily include all tests required for Schedule 5 or J. The tests shall be performed as prescribed for that classification in the AWS standard.

5.5 Schedule 5 or J

Results of all of the tests required for classification in the AWS, ISO, or other applicable welding consumable standard for the specific lot of consumables shall be supplied.

Table 1
Testing Schedules^a

Schedule^b	Requirements	Reference Clause
1 or F	The manufacturer's standard testing schedule	5.1
2 or G	Classification tests from product manufactured within 12 months preceding the date of the purchase order	5.2
3 or H	Chemical analysis of <i>the specific lot</i>	5.3
4 or I	Tests called for by Table 2, for <i>the specific lot</i>	5.4
5 or J	All tests prescribed for classification in the AWS, ISO, or other applicable welding consumable standard, for <i>the specific lot</i>	5.5
6 or K	All tests specified by the purchaser for <i>the specific lot</i>	5.6

^a Testing shall be conducted in accordance with the applicable filler metal classification standard, unless otherwise agreed upon by purchaser and seller.

^b Either the numeric or alphabetic designations may be used interchangeably.

5.6 Schedule 6 or K

In addition to, or in place of, any of the tests called for in the AWS, ISO, or other applicable welding consumable standard, the purchaser may require other tests (such as testing after a specified heat treatment). In all such cases, the purchaser shall identify on the purchase order the specific tests that are to be conducted, the procedures to be followed, the requirements that shall be met and the results to be reported *for the specific lot of consumables*.

Table 2
Schedule 4 or I—Required Tests^{a, b, c}

Product Type	Carbon Steel	Low-Alloy Steel	Stainless Steel	Nickel and Ni-Alloy	Surfacing	Cast Iron	Aluminum and Al-Alloy	Copper and Cu-Alloy	Magnesium and Mg-Alloy	Titanium and Ti-Alloy	Zirconium and Zr-Alloy	Brazing and Braze Welding Filler Metals
Covered Solid and Metal Cored (Composite) Electrodes for SMAW	(A5.1) 1, 2, 3, 4, 5 ^d	(A5.5) 1, 2, 3, 4, 5 ^d	(A5.4) 1	(A5.11) 1, 2, 4, 6	(A5.13) 1	(A5.21) 1	(A5.3) 1	(A5.6) 1, 4	—	—	—	—
Bare Solid and Metal Cored (Composite) Rods and Electrodes for GTAW, PAW, GMAW, EGW	(A5.18, A5.36) 1, 2, 4	(A5.26) 1, 2, 3, 4	(A5.9) 1	(A5.14) 1	(A5.13) 1	(A5.21) 1	(A5.10) 1, 4 ^e , 9 ^e	(A5.7) 1	(A5.19) 1	(A5.16) 1	(A5.24) 1	—
Bare Solid and Metal Cored (Composite) Electrodes for SAW	(A5.17) 1	(A5.23) 1	(A5.9) 1	(A5.14) 1	—	—	—	—	—	—	—	—
Flux Cored Electrodes for FCAW and EGW	(A5.20, A5.36) 1, 2, 3, 4	(A5.26) 1, 2, 3, 4	(A5.22) 1	(A5.34) 1	—	(A5.15) 1	—	—	—	—	—	—
Solid or Metal Cored Electrode—Flux Combinations for SAW and ESW	(A5.17) 1, 2, 3, 4	(A5.23) 1, 2, 3, 4	—	—	—	(A5.15) 1	—	—	—	—	—	—
Solid and Composite Rods for OFW	(A5.2) 1	(A5.2) 1	—	—	(A5.13) 1	(A5.21) 1	(A5.10) 1, 9	(A5.7) 1	(A5.19) 1	—	—	—

(Continued)

Table 2 (Continued)
Schedule 4 or I—Required Tests^{a, b, c}

Product Type	Carbon Steel	Low-Alloy Steel	Stainless Steel	Nickel and Ni-Alloy	Surfacing	Cast Iron	Aluminum and Al-Alloy	Copper and Cu-Alloy	Magnesium and Mg-Alloy	Titanium and Ti-Alloy	Zirconium and Zr-Alloy	Brazing and Braze Welding Filler Metals
Consumable Inserts	(A5.30) 1	(A5.30) 1	(A5.30) 1	(A5.30) 1	—	—	—	—	—	—	—	—
Bare Brazing and Braze Welding Filler Metals	—	—	—	—	—	—	—	—	—	—	—	(A5.8) 1
Vacuum Grade Brazing Fillers	—	—	—	—	—	—	—	—	—	—	—	(A5.8) 1
Brazing Metal Powders	—	—	—	—	—	—	—	—	—	—	—	(A5.8) 1, 8

^a Designations in parentheses refer to the AWS filler metal specification.

^b Tests called for in this table shall be performed only when they are required by the applicable AWS specification for the particular classification involved. Tests shall be performed in the manner prescribed by the applicable specification. Testing to one current and polarity shall be adequate.

^c Test Designations are as follows:

- 1—Chemical analysis
- 2—Tensile
- 3—Impact
- 4—Soundness (x-ray)
- 5—Moisture test
- 6—Bend (face, side, or both)
- 7—Spattering characteristics
- 8—Sieve analysis
- 9—Bead-on-plate weld test
- ^d Low-hydrogen electrodes only
- ^e Test 4—for electrodes
- Test 9—for rods

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Annex A (Normative)

Quality Assurance

This annex is part of AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD), *Welding Consumables—Procurement of Filler Materials and Fluxes*, and includes mandatory elements for use with this standard.

A1. Manufacturer's or Supplier's Quality Assurance System

A1.1 The certification of the product is accomplished through a quality assurance program, by which the manufacturer or supplier verifies that the product meets the requirements of this specification. Such a program includes planning, documentation, surveillance, inspection, testing, and certification of the test results. It also includes control of the inspection and measuring equipment, as well as control of any nonconforming material. It involves auditing of the activities and provides for developing and implementing any corrective action that may become necessary.

A1.2 It is the responsibility of the purchaser to review the quality assurance program of the manufacturer or supplier for conformance to the purchaser's specific requirements.

A1.3 Suppliers who receive electrodes in bulk and package them for distribution, or who repackage under their own label shall as a minimum maintain an adequate control system to ensure that the package contents are traceable to the original manufacturer's records. Additional quality assurance requirements shall be as agreed between the purchaser and the supplier.

A1.4 See AWS A5.02/A5.02M:2007, *Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes*, for packaging information. ISO 544, *Welding Consumables — Technical Delivery Conditions for Welding Filler Materials — Type of Product, Dimensions, Tolerances and Markings*, could also be a suitable standard.

A2. Retest

If the results of any test fail to meet the requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Material, specimens, or samples for retest may be taken from the original test assembly or sample, or from a new test assembly or sample. For chemical analysis, retest need be only for those specific elements that failed to meet the test requirement. If the results of one or both retests fail to meet the requirement, the material under test shall be considered as not meeting the requirements of this specification for that classification.

In the event that, during preparation or after completion of any test, it is clearly determined that prescribed or proper procedures were not followed in preparing the weld test assembly or test specimen(s) or test sample(s), or in conducting the test, the test shall be considered invalid, without regard to whether the test was actually completed, or whether test results met, or failed to meet, the requirement. That test shall be repeated, following proper prescribed procedures. In this case, the requirement for doubling the number of test specimens does not apply.

A3. Supplementary Requirements—Department of Defense

When specified for products used in construction for the United States Department of Defense, one or more of the following clauses may be used in contracts

A3.1 Alloy Identity. Alloy identity procedures provide type separation through quality checks at all phases of production in the manufacture of filler metals. The test method may include chemical analysis, metal sorting devices, other

approved methods or a combination of methods. When required, alloy identity procedures shall be specified in Procurement Detail Forms using Item III, "Other Requirements." See Tables B.1 through B.7 (in Annex B) for Procurement Detail Forms and examples of their use.

A3.1.1 Electrode, Rod, and Core Wire Alloy Identity. Each end of rod, wire, or strip to be spliced during processing shall be tested for alloy identity prior to rewinding, spooling, or straightening and cutting into rods or electrode core wire lengths.

A3.1.2 Single Coil. For continuous process operations where a single rod coil is drawn to finish size, straightened, and cut to length without removal from the machine, both ends of each rod coil shall be alloy identity tested immediately prior to the start of the continuous processing operation.

A3.1.3 Multiple Coils. When multiple coils are to be spliced during continuous processing operations, each end of each coil to be spliced shall be alloy identity tested at the process station just prior to splicing. In addition, the leading end of the first coil and the tail end of the last coil for each continuous process run shall be alloy identity tested.

Annex B (Informative)

Guide to *Welding Consumables— Procurement of Filler Materials and Fluxes*

This annex is not part of AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD), *Welding Consumables—Procurement of Filler Materials and Fluxes*, but is included for informational purposes only.

B1. Introduction

This guide is appended to the specification as a source of information; it is not mandatory and does not form a part of the specification. Its purpose is to provide descriptive information and examples that will aid in the use of AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD), *Welding Consumables—Procurement of Filler Materials and Fluxes*.

B2. General Information

The general requirements, testing requirements and procedures, method of manufacture, identification, and packaging for filler metals are specified in the filler metal specification and are not intended to be duplicated or modified in this specification, except as the purchaser specifies. The complete list of AWS filler metal specifications including AWS A5.02/A5.02M:2007, *Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes*, is given for reference in the back of this document.

Those specifications, used in conjunction with these Procurement Guidelines, provide a basis for specifying in a procurement document the filler metal requirements in a precise, reproducible, uniform manner.

The Procurement Detail Forms in Tables B.1 through B.5 are suggested forms intended to serve as a check list for detailing filler metal requirements for procurement. They could also serve as a basis for efficient communication between departments within an organization (e.g., communication between welding or production departments and purchasing concerning the specific requirements for filler metal to be procured).

B3. Acceptance

The acceptance of welding consumables classified under AWS filler metal specifications is in accordance with the tests and requirements of the applicable filler metal specification. Any testing a purchaser requires of the supplier, for filler metal shipped in accordance with a filler metal specification, needs to be clearly stated in the purchase order according to the provisions of this specification. In the absence of any such statement in the purchase order, the supplier may ship the filler metal with whatever testing the supplier normally conducts on filler metal of that classification. Thus, the default for testing schedule is Schedule 1 or F, and the default for Lot Class is S1, T1, C1, or F1, as applicable. Testing in accordance with any other Schedule or classification to any other Lot Class must be specifically required by the purchase order. In such cases, acceptance of the material shipped will be in accordance with those requirements.

B4. Certification

The act of placing the AWS specification and classification designations, and optional supplemental designators, if applicable on the packaging enclosing the product, or the classification on the product itself, constitutes the supplier's or manufacturer's certification that the product meets all of the requirements of the specification. The only testing require-

ment implicit in this certification is that the manufacturer has actually conducted the tests required by the specification on material that is representative of that being shipped and that material met the requirements of the specification. Representative material, in this case, is material from any production run of that classification using the same formulation. Certification is not to be construed to mean that tests of any kind were necessarily conducted on samples of the specific material shipped. Tests on such material may or may not have been conducted. The basis for the certification required by the specification is the classification test of representative material cited above, and the Manufacturer's Quality Assurance Program in AWS A5.01M/A5.01 (ISO 14344 MOD).

B5. Examples

Examples of the manner in which the Procurement Detail Forms might be used are given in Tables B.6 and B.7.

In Table B.6, the four examples demonstrate the manner in which different packaging, lot classification, supplemental designators, and testing requirements would be specified in a purchase order for 1000 lb of 3/16 in diameter E7018 electrodes. The differences are summarized below.

Example 1: The test and certification requirements specified are those the manufacturer of the electrodes uses as "standard practice" in the conduct of the Manufacturer's business (see Table 1 in the body of this specification).

Example 2: Requirements include 10 lb unit packages, a -1 (read as "dash one") supplemental designator, and, for the lot supplied, a certificate showing the results of the chemical analysis, the tensile, impact, and soundness tests, and the moisture content of the covering (for low-hydrogen electrodes, as the filler metal specification requires). (See Tables 1 and 2.) The lot classification, in this case, is the manufacturer's standard lot (see 4.3.1).

Example 3: Requirements include 10 lb unit packages, an H4 supplemental designator, and, for the lot supplied, a certificate showing the results of all tests AWS A5.1 requires for the classification of E7018 electrodes. The definition of the lot classification, in this case, is given in 4.3.3.

Example 4: The requirements here are the same as in Example 3, except that the electrode length is 18 in and the supplemental designator is H4R. The lot classification is as defined in 4.3.2 and the level of testing is that which the purchaser has specified in Item III, Other Requirements. Those tests, in this case, would be the tests required for classification of the electrode, except that the mechanical property tests (strength and toughness) would be conducted on weld metal obtained from the test assembly after the assembly had been given a postweld heat treatment at $650^{\circ}\text{C} \pm 15^{\circ}\text{C}$ [$1200^{\circ}\text{F} \pm 25^{\circ}\text{F}$] for 12 hours with the heating and cooling rates specified in Item III, Other Requirements.

Examples 5 and 6: Table B.7 demonstrates the use of the Procurement Detail Form for listing the requirements for obtaining straight lengths (rods) and spooled (electrode) aluminum filler metal to filler metal specification AWS A5.10/A5.10M, *Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods*. Example 5 is for rods and Example 6 is for spooled electrodes. In both cases, the tests to be conducted are those called for in Table 2, as indicated by Schedule 4 or I (see Table 1 for description). The tests for aluminum rods are different from those for aluminum electrodes, but no other requirements are specified in this case.

Table B.1
Suggested Procurement Detail Form for Covered Electrodes

I. General	_____
A. Quantity	_____
B. AWS Specification	_____
C. AWS Classification	_____
D. Supplemental Designators if required	_____
E. Diameter	_____
F. Length	_____
G. Unit Package Type and Weight	_____
1. Carton	_____
2. Can	_____
3. Other	_____
II. Certification and Testing	_____
A. Lot Classification (4.3)	_____
B. Level of Testing (5.1 through 5.6)	_____
III. Other Requirements	_____

Table B.2
Suggested Procurement Detail Form
for Bare Solid Electrodes and Rods

I. General	_____
A. Quantity	_____
B. AWS Specification	_____
C. AWS Classification	_____
D. Supplemental Designators if required	_____
E. Diameter	_____
F. Length (for rods)	_____
G. Unit Package Type and Weight	_____
1. Spool	_____
2. Coil with Support	_____
3. Coil without Support	_____
4. Rim (reel)	_____
5. Drum	_____
6. Straight Lengths	_____
7. Other	_____
II. Certification and Testing	_____
A. Lot Classification (4.1)	_____
B. Level of Testing (5.1 through 5.6)	_____
III. Other Requirements	_____

Table B.3
Suggested Procurement Detail Form for
Flux Cored and Metal Cored Electrodes and Rods

I. General	_____
A. Quantity	_____
B. AWS Specification	_____
C. AWS Classification	_____
D. Supplemental Designators if required	_____
E. Diameter	_____
F. Unit Package Type and Weight	_____
1. Spool	_____
2. Coil with Support	_____
3. Coil without Support	_____
4. Rim (reel)	_____
5. Drum	_____
6. Other	_____
II. Certification and Testing	_____
A. Lot Classification (4.2)	_____
B. Level of Testing (5.1 through 5.6)	_____
III. Other Requirements	_____

Table B.4
Suggested Procurement Detail form for Submerged Arc
Electrodes and Flux and Brazing and Braze Welding Filler Metal

	Electrode	Flux
I. General	_____	_____
A. Quantity	_____	_____
B. AWS Specification	_____	_____
C. AWS Classification	_____	_____
D. Supplemental Designators if required	_____	_____
E. Diameter	_____	_____
F. Unit Package Type and Weight	_____	_____
1. Spool	_____	_____
2. Coil with Support	_____	_____
3. Coil without Support	_____	_____
4. Rim (reel)	_____	_____
5. Drum	_____	_____
6. Bag, Box, or Drum (for flux)	_____	_____
7. Other	_____	_____
II. Certification and Testing	_____	_____
A. Lot Classification (4.1 and 4.4)	_____	_____
B. Level of Testing (5.1 through 5.6)	_____	_____
III. Other Requirements	_____	_____

Table B.5
Suggested Procurement Detail Form for Consumable Inserts

I. General	_____
A. Quantity ^a	_____
B. AWS Specification	_____
C. AWS Classification	_____
D. Shape (Class)	_____
E. Style	_____
F. Size	_____
II. Certification and Testing	_____
A. Lot Classification (4.1)	_____
B. Level of Testing (5.1 through 5.6)	_____
III. Other Requirements	_____

^a Number of pieces or meters [feet], according to the style.

Table B.6
Example of Use of the Procurement Detail Form for Covered Electrodes

	Examples			
	1	2	3	4
I. General				
A. Quality	1000 lbs	1000 lbs	1000 lbs	1000 lbs
B. AWS Specification	A5.1	A5.1	A5.1	A5.1
C. AWS Classification	E7018	E7018	E7018	E7018
D. Supplemental Designators		-1	H4	H4R
E. Diameter	3/16 in	3/16 in	3/16 in	3/16 in
F. Length	14 in	14 in	14 in	18 in
G. Unit Package Type and Weight				
1. Carton	50 lb			
2. Can		10 lb	10 lb	10 lb
3. Other				
II. Certification and Testing				
A. Lot Classification	C1	C1	C3	C2
B. Level of Testing	Schedule 1 or F	Schedule 4 or I	Schedule 5 or J	Schedule 6 or K
III. Other Requirements (Example No. 4 Only)	The lots of electrodes that are shipped must meet all classification test requirements of the specification. The strength and toughness of the weld metal must meet specification requirements after a postweld heat treatment at 1200°F ± 25°F for 12 hours. The heating and cooling rates above 600°F shall not exceed 200°F/hour.			

Table B.7
Example of Use of the Procurement Detail Form for Bare Solid Aluminum Electrodes and Rods

	Example 5	Example 6
I. General		
A. Quality	400 lbs	1000 lbs
B. AWS Specification	A5.10	A5.10
C. AWS Classification	R4043	ER4043
D. Diameter	3/32 in	3/64 in
E. Length	36 in	—
F. Unit Package Type and Weight		
1. Spool	—	4 in, 1 lb
2. Coil with Support	—	—
3. Coil without Support	—	—
4. Rim (reel)	—	—
5. Drum	—	—
6. Straight	5 lbs	—
II. Certification and Testing		
A. Lot Classification	Class S2	Class S2
B. Level of Testing	Schedule 4 or I	Schedule 4 or I
III. Other Requirements	None	None

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Annex C (*Informative*)

Guidelines for Preparation of Technical Inquiries

This annex is not part of AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD), *Welding Consumables—Procurement of Filler Materials and Fluxes*, but is included for informational purposes only.

C1. Introduction

The American Welding Society (AWS) Board of Directors has adopted a policy whereby all official interpretations of AWS standards are handled in a formal manner. Under this policy, all interpretations are made by the committee that is responsible for the standard. Official communication concerning an interpretation is directed through the AWS staff member who works with that committee. The policy requires that all requests for an interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some interpretations may require considerable time.

C2. Procedure

All inquiries shall be directed to:

Managing Director
Technical Services Division
American Welding Society
8669 NW 36 St, # 130
Miami, FL 33166

All inquiries shall contain the name, address, and affiliation of the inquirer, and they shall provide enough information for the committee to understand the point of concern in the inquiry. When the point is not clearly defined, the inquiry will be returned for clarification. For efficient handling, all inquiries should be typewritten and in the format specified below.

C2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry along with the edition of the standard that contains the provision(s) the inquirer is addressing.

C2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be to obtain an interpretation of a standard's requirement or to request the revision of a particular provision in the standard.

C2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to understand the point of the inquiry. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annex) that bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

C2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry or provide the wording for a proposed revision, if this is what the inquirer seeks.

C3. Interpretation of Provisions of the Standard

Interpretations of provisions of the standard are made by the relevant AWS technical committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the portion of the standard addressed by the inquiry. The subcommittee reviews the inquiry and the proposed reply to determine what the response to the inquiry should be. Following the subcommittee's development of the response, the inquiry and the response are presented to the entire committee for review and approval. Upon approval by the committee, the interpretation is an official interpretation of the Society, and the secretary transmits the response to the inquirer and to the *Welding Journal* for publication.

C4. Publication of Interpretations

All official interpretations will appear in the *Welding Journal* and will be posted on the AWS web site.

C5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning AWS standards should be limited to questions of a general nature or to matters directly related to the use of the standard. The AWS *Board Policy Manual* requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS standard with the information that such an interpretation can be obtained only through a written request. Headquarters staff cannot provide consulting services. However, the staff can refer a caller to any of those consultants whose names are on file at AWS Headquarters.

C6. AWS Technical Committees

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees or to consideration of revisions to existing provisions on the basis of new data or technology. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on (1) specific engineering problems, (2) requirements of standards applied to fabrications outside the scope of the document, or (3) points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest.

Annex D (*Informative*)

List of Deviations from ISO 14344:2010

This annex is not part of AWS A5.01M/A5.01:2013 (ISO 14344:2010 MOD), *Welding Consumables—Procurement of Filler Materials and Fluxes*, but is included for informational purposes only.

Global change: Revised organization and wording of document for simplicity and clarity. “Identification” clause was removed and added to “Terms and Definitions” or “Lot Classification” clauses as necessary. Various forms of fully metallic welding consumables were consolidated with no substantive changes in lot classifications and testing schedules. Removed 24-hour restriction from Lot Class C3 for consistency with other lot classifications. Defined the term “Production Schedule.” Changed wording in several places from “for each lot shipped” to “for each lot supplied.”

Added Normative Annex A: Quality Assurance

Added Informative Annex B: Guide to *Welding Consumables—Procurement of Filler Materials and Fluxes*

Added Informative Annex C: Guidelines for Preparation of Technical Inquiries

Added Informative Annex D: List of Deviations from ISO 14344:2010

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AWS Filler Metal Specifications by Material and Welding Process

	OFW	SMAW	GTAW GMAW PAW	FCAW	SAW	ESW	EGW	Brazing
Carbon Steel	A5.2	A5.1	A5.18, A5.36	A5.20, A5.36	A5.17	A5.25	A5.26	A5.8, A5.31
Low-Alloy Steel	A5.2	A5.5	A5.28, A5.36	A5.29, A5.36	A5.23	A5.25	A5.26	A5.8, A5.31
Stainless Steel		A5.4	A5.9, A5.22	A5.22	A5.9	A5.9	A5.9	A5.8, A5.31
Cast Iron	A5.15	A5.15	A5.15	A5.15				A5.8, A5.31
Nickel Alloys		A5.11	A5.14	A5.34	A5.14	A5.14		A5.8, A5.31
Aluminum Alloys		A5.3	A5.10					A5.8, A5.31
Copper Alloys		A5.6	A5.7					A5.8, A5.31
Titanium Alloys			A5.16					A5.8, A5.31
Zirconium Alloys			A5.24					A5.8, A5.31
Magnesium Alloys			A5.19					A5.8, A5.31
Tungsten Electrodes			A5.12					
Brazing Alloys and Fluxes								A5.8, A5.31
Surfacing Alloys	A5.21	A5.13	A5.21	A5.21	A5.21			
Consumable Inserts			A5.30					
Shielding Gases			A5.32	A5.32			A5.32	

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AWS Filler Metal Specifications and Related Documents

Designation	Title
FMC	<i>Filler Metal Comparison Charts</i>
IFS	<i>International Index of Welding Filler Metal Classifications</i>
UGFM	<i>User's Guide to Filler Metals</i>
A4.2M (ISO 8249 MOD)	<i>Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal</i>
A4.3	<i>Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding</i>
A4.4M	<i>Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings</i>
A4.5M/A4.5 (ISO 15792-3 MOD)	<i>Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld</i>
A5.01M/A5.01 (ISO 14344 MOD)	<i>Welding Consumables—Procurement of Filler Metals and Fluxes</i>
A5.02/A5.02M	<i>Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes</i>
A5.1/A5.1M	<i>Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding</i>
A5.2/A5.2M	<i>Specification for Carbon and Low-Alloy Steel Rods for Oxyfuel Gas Welding</i>
A5.3/A5.3M	<i>Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding</i>
A5.4/A5.4M	<i>Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding</i>
A5.5/A5.5M	<i>Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding</i>
A5.6/A5.6M	<i>Specification for Copper and Copper-Alloy Electrodes for Shielded Metal Arc Welding</i>
A5.7/A5.7M	<i>Specification for Copper and Copper-Alloy Bare Welding Rods and Electrodes</i>
A5.8/A5.8M	<i>Specification for Filler Metals for Brazing and Braze Welding</i>
A5.9/A5.9M	<i>Specification for Bare Stainless Steel Welding Electrodes and Rods</i>
A5.10/A5.10M (ISO 18273 MOD)	<i>Welding Consumables—Wire Electrodes, Wires and Rods for Welding of Aluminum and Aluminum-Alloys—Classification</i>
A5.11/A5.11M	<i>Specification for Nickel and Nickel-Alloy Welding Electrodes for Shielded Metal Arc Welding</i>
A5.12M/A5.12 (ISO 6848 MOD)	<i>Specification for Tungsten and Oxide Dispersed Tungsten Electrodes for Arc Welding and Cutting</i>
A5.13/A5.13M	<i>Specification for Surfacing Electrodes for Shielded Metal Arc Welding</i>
A5.14/A5.14M	<i>Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods</i>
A5.15	<i>Specification for Welding Electrodes and Rods for Cast Iron</i>
A5.16/A5.16M (ISO 24034 MOD)	<i>Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods</i>
A5.17/A5.17M	<i>Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding</i>
A5.18/A5.18M	<i>Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding</i>
A5.19	<i>Specification for Magnesium Alloy Welding Electrodes and Rods</i>
A5.20/A5.20M	<i>Specification for Carbon Steel Electrodes for Flux Cored Arc Welding</i>
A5.21/A5.21M	<i>Specification for Bare Electrodes and Rods for Surfacing</i>
A5.22/A5.22M	<i>Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods</i>
A5.23/A5.23M	<i>Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding</i>
A5.24/A5.24M	<i>Specification for Zirconium and Zirconium-Alloy Welding Electrodes and Rods</i>
A5.25/A5.25M	<i>Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding</i>
A5.26/A5.26M	<i>Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding</i>
A5.28/A5.28M	<i>Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding</i>
A5.29/A5.29M	<i>Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding</i>
A5.30/A5.30M	<i>Specification for Consumable Inserts</i>
A5.31M/A31	<i>Specification for Fluxes for Brazing and Braze Welding</i>
A5.32M/A5.32 (ISO 14175 MOD)	<i>Welding Consumables—Gases and Gas Mixtures for Fusion Welding and Allied Processes</i>
A5.34/A5.34M	<i>Specification for Nickel-Alloy Electrodes for Flux Cored Arc Welding</i>
A5.36/A5.36M	<i>Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding</i>

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