

AWS A5.01M/A5.01:2008
(ISO 14344:2002 MOD)
An American National Standard

Procurement Guidelines for Consumables— Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes



American Welding Society



AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD)
An American National Standard

Approved by the
American National Standards Institute
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Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes

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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 an AWS 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.



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American Welding Society

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Foreword

This foreword is not part of AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD), *Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*, but is included for informational purposes only.

This AWS A5.01M/A5.01 standard is a modified adoption of International Standard ISO 14344:2002, *Procurement guidelines for consumables — Welding and allied processes — Flux and gas shielded electrical welding processes*. 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 complete list of modifications, together with their justification, is given in Annex E.

This document is the first of the AWS A5.01 specifications which 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 specification. The current document is the third 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 Committee on Filler Metals. The 1993 revision was prepared by a permanent subcommittee (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>

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 standard are welcome. They should be sent to the Secretary, AWS A5 Committee on Filler Metals and Allied Materials, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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Procurement guidelines for consumables — Welding and allied processes — Flux and gas shielded electrical welding processes

1 Scope

This standard is a tool for communication between a purchaser and a supplier of welding consumables within quality systems as might, for example, be based upon ISO 9001. 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 welding consumable standard);
- b) the lot classification (selected from Clause 5 of this standard);
- c) the testing schedule (selected from Clause 6 of this standard).

Selection of the specific welding consumable classification, lot classification 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 standard is referenced in the mandatory section of this document:

AWS A5.02/A5.02M¹, *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 E 29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

2.3 The following ISO standard is referenced in the mandatory section of this document:

ISO 544³, *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, 550 N.W. LeJeune Road, Miami, FL 33126.

² ASTM standards are published by the American Society for Testing and Materials, 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 are divided into discrete, predetermined 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 type and source of 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 terms and definitions apply.

3.1 dry batch

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

NOTE Liquid binder, when added to a dry batch, produces a wet mix. A dry batch may be divided into smaller quantities, in which case addition of the liquid binder produces as many wet mixes as there were smaller quantities.

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 which, when the liquid binder is added, produce one or more wet mixes.

3.3 wet mix

combination of liquid binder and a dry batch or dry blend, or a portion thereof, mixed at one time in one mixing vessel

3.4 heat

for consumable inserts, brazing and braze welding filler metals, solid electrodes and rods, core wire for covered electrodes, and the sheath (strip or tubing) of tubular cored electrode wire and rod, is one of the following, depending on the method of melting and refining of the metal:

- the material obtained from one furnace melt, where slag-metal or gas-metal reactions occur in producing the metal (e.g., open hearth, electric arc, basic oxygen, argon-oxygen processes);
- 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 metal (e.g., induction melting in a controlled atmosphere or in a vacuum);
- an uninterrupted series of remelts in one furnace under the same remelting conditions using one or more consumable electrodes produced from a heat, as defined, 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).

4 Identification

4.1 General

Identification of consumable inserts, brazing and braze welding filler metals, solid electrode wire and strip, rods, core wire for covered electrodes, and the sheath (strip or tubing) of tubular cored electrodes and rods shall be applied as listed in 4.2 to 4.5.

4.2 Heat number

Solid wire, electrode core wire, rod, strip, brazing filler metals, and consumable inserts, identified by heat number, shall consist of material from a single heat of metal.

4.3 Controlled chemical composition

Solid wire, electrode core wire, rod, strip, brazing and braze welding filler metals, and consumable inserts identified by controlled chemical composition, rather than by heat number, shall consist of mill coils of one or more heats from which samples have been taken for chemical analysis. The results of the analysis of each sample shall be within the manufacturer's composition limits for that material. Coils from mills that do not permit spliced-coil practice need be sampled on only one end. Coils from mills that permit spliced-coil practice shall be sampled on both ends and shall have no more than a single splice per coil.

4.4 Covering mix

In the production of covered electrodes, the covering mix shall be identified in one of the following two manners:

- a) **wet mix:** a covering identified by wet mix shall consist of a single wet mix for each lot of electrodes;
- b) **controlled chemical composition:** a covering identified by controlled chemical composition (rather than by wet mix) shall consist of one or more wet mixes and be subjected to sufficient tests to assure that all wet mixes 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.

4.5 Core ingredients

In the production of tubular cored electrode wire or rod (flux cored or metal cored welding consumables), the core ingredients shall be identified in one of the following manners:

- a) **dry blend:** core ingredients identified by dry blend shall consist of a single dry batch or dry blend;
- b) **controlled chemical composition:** core ingredients identified by controlled composition shall consist of one or more dry blends and be subjected to sufficient tests to assure that all dry blends 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.

5 Lot classification

5.1 Bare solid electrode wires and strips, rods, brazing and braze welding filler metals, and consumable inserts

5.1.1 Class S1

A Class S1 lot of bare solid electrode wires and strips, rods, brazing and braze welding filler metals or consumable inserts is the manufacturer's standard lot, as defined in the manufacturer's quality assurance programme.

5.1.2 Class S2

A Class S2 lot of bare solid electrode wires and strips, rods, brazing and braze welding filler metals or consumable inserts is the quantity, not exceeding 45 000 kg [100 000 lb], of one classification, size, form and temper produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts). Class S2 solid electrodes and rods or consumable inserts shall be produced from one heat (4.2) or from material identified by controlled chemical composition (4.3).

5.1.3 Class S3

A Class S3 lot of bare solid electrode wires and strips, rods, brazing and braze welding filler metals or consumable inserts is the quantity of one size produced in one production schedule from one heat (4.2).

5.1.4 Class S4

A Class S4 lot of bare solid electrode wires and strips, rods, brazing and braze welding filler metals or consumable inserts is the quantity, not exceeding 45 000 kg [100 000 lb], of one classification, size, form and temper produced under one production schedule. Class S4 solid electrodes and rods or consumable inserts shall be produced from one heat (4.2) or from material identified by controlled chemical composition (4.3).

5.2 Tubular cored electrodes and rods**5.2.1 Class T1**

A Class T1 lot of tubular cored electrodes and rods is the manufacturer's standard lot, as defined in the manufacturer's quality assurance programme.

5.2.2 Class T2

A Class T2 lot of tubular cored electrodes and rods is the quantity, not exceeding 45 000 kg [100 000 lb], of one classification and size produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts). Class T2 tubular cored electrodes and rods shall be produced from tube or strip identified by heat number (4.2) or by controlled chemical composition (4.3). Identification of the core ingredients shall be as specified in 4.5 a) or 4.5 b).

5.2.3 Class T3

A Class T3 lot of tubular cored electrodes and rods is the quantity produced from one heat (4.2) and one dry batch (3.1) or one dry blend (3.2) of core materials. Identification of the core ingredients shall be as specified in 4.5 a).

5.2.4 Class T4

A Class T4 lot of tubular cored electrodes and rods is the quantity, not exceeding 45 000 kg [100 000 lb], of one classification and size produced under one production schedule from tube or strip identified by heat number (4.2) or controlled chemical composition (4.3). Identification of the core ingredients shall be as specified in 4.5 a) or 4.5 b).

5.3 Covered electrodes**5.3.1 Class C1**

A Class C1 lot of covered electrodes is the manufacturer's standard lot, as defined in the manufacturer's quality assurance programme.

5.3.2 Class C2

A Class C2 lot of covered electrodes is the quantity, not exceeding 45 000 kg [100 000 lb], of any one size and classification produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts).

5.3.3 Class C3

A Class C3 lot of covered electrodes is the quantity, not exceeding 45 000 kg [100 000 lb], of any one size and classification produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts).

Class C3 electrodes shall be produced from covering identified by wet mix [4.4 a)] or controlled chemical composition [4.4 b)] and core wire identified by heat number (4.2) or controlled chemical composition (4.3).

5.3.4 Class C4

A Class C4 lot of covered electrodes is the quantity of any one size and classification produced from one wet mix [4.4 a)] and one heat of core wire (4.2).

5.3.5 Class C5

A Class C5 lot of covered electrodes is the quantity of one size and classification produced from one dry blend of covering mixture (3.2) and one heat of core wire (4.2).

5.4 Fluxes for submerged arc welding

5.4.1 Class F1

A Class F1 lot of flux is the manufacturer's standard lot, as defined in the manufacturer's quality assurance programme.

5.4.2 Class F2

A Class F2 lot of flux is the quantity produced from the same combination of raw materials under one production schedule.

6 Level of testing

6.1 General

The level of the testing schedule shall be selected by the purchaser from those listed in Table 1. If no level of testing schedule is specified, the level shall be Schedule 1 or F.

6.2 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 standard (or other 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. The class of each lot will be the manufacturer's standard.

Table 1
Testing Schedules

Schedule ^a	Requirements	Reference Clause
1 or F	The manufacturer's standard testing schedule	6.2
2 or G	Tests from production runs of the product within 12 months preceding the date of the purchase order	6.3
3 or H	Chemical analysis only, for each lot shipped	6.4
4 or I	Tests called for by Table 2, for each lot shipped	6.5
5 or J	All tests which the classification called for in the pertinent AWS, ISO or other welding consumable standard, for each lot shipped	6.6
6 or K	All tests specified by the purchaser for each lot shipped	6.7

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

6.3 Schedule 2 or G

Test results shall be supplied from any production run of the product made within the twelve months preceding the date of the purchase order. This shall include the results of all tests prescribed for that classification in the AWS/ISO or other applicable standard. The class of each lot is the manufacturer's standard.

6.4 Schedule 3 or H

Chemical analysis of each lot shipped shall be supplied by the manufacturer. The analysis shall include those elements prescribed for that classification in the AWS/ISO or other applicable standard. The class of each lot shall be specified by the purchaser from those listed in Clause 5 of this standard.

6.5 Schedule 4 or I

Results of the tests called for in Table 2 shall be supplied by the manufacturer for each lot shipped. 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/ISO or other applicable standard. The class of each lot shall be specified by the purchaser from those listed in Clause 5.

6.6 Schedule 5 or J

Results of all of the tests prescribed for that classification in the AWS/ISO or other applicable standard shall be supplied by the manufacturer for each lot shipped. The class of each lot shall be specified by the purchaser from those listed in Clause 5.

6.7 Schedule 6 or K

In addition to, or in place of, any of the tests called for in the AWS/ISO or other applicable 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 by the manufacturer. The class of each lot shall be specified by the purchaser from those listed in Clause 5.

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	(A5.15) 1	(A5.3) 1	(A5.6) 1, 4	—	—	—	—
Bare Solid and Metal Cored (Composite) Rods and Electrodes for GTAW, PAW, GMAW, EGW	(A5.18) 1, 2, 4	(A5.26) 1, 2, 3, 4	(A5.26) 1, 2, 3, 4	(A5.28) 1, 2, 4	(A5.9) 1	(A5.14) 1	(A5.13) 1	(A5.21) 1	(A5.15) 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) 1, 2, 3, 4	(A5.26) 1, 2, 3, 4	(A5.26) 1, 2, 3, 4	(A5.29) 1, 2, 3, 4	(A5.22) 1	—	—	—	(A5.15) 1	—	—	—	—	—	—
Solid or Metal Cored Electrode—Flux Combinations for SAW and ESW	(A5.17) 1, 2, 3, 4	(A5.25) 1, 2, 3, 4	(A5.23) 1, 2, 3, 4	(A5.25) 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	(A5.15) 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	6 Bend (face, side, or both)
2 Tensile	7 Spattering characteristics
3 Impact	8 Sieve analysis
4 Soundness (x-ray)	9 Bead-on-plate weld test
5 Moisture test	

^d Low hydrogen electrodes only

^e Test 4—for electrodes
Test 9—for rods

National Annexes

Annex A (Normative)

Quality Assurance

This annex is part of AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD), *Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*, and includes mandatory elements for use with this standard.

A1. Manufacturer's Quality Assurance System

A1.1 The certification of the product is accomplished through a quality assurance program, by which the manufacturer 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 for conformance to the purchaser's specific requirements.

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

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 weld-ing filler materials — Type of product, dimensions, toler-ances 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 sam-ples for retest may be taken from the original test assem-bly or sample, or from a new test assembly or sample. For chemical analysis, retest need be only for those spe-cific elements that failed to meet the test requirement. If the results of one or both retests fail to meet the require-ment, 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 require-ment 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 U.S. Department of Defense, one or more of the follow-ing 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 B1 through B7/B7M (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 *Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*

This annex is not part of AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD), *Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*, 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/A5.01:2008 (ISO 14344:2002 MOD), *Procurement guidelines for consumables—Welding and allied processes—Flux and gas shielded electrical welding processes*.

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 communica-

tion 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).

Examples of the manner in which the Procurement Detail Forms might be used are given in Tables B.6/B.6M, and B.7/B.7M. In Tables B.6 and B.6M, 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 500 kg [1000 lb] of 5 mm [3/16 in] diameter E4918 [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 5 kg [10 lb] unit packages, a -1 (read as “dash one”) supplemental designator, and, for the lot shipped, 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 5.3.1).

Example 3: Requirements include 5 kg [10 lb] unit packages, an H4 supplemental designator, and, for the lot shipped, a certificate showing the results of all tests AWS A5.1 requires for the classification of E4918 [E7018] electrodes. The definition of the lot classification, in this case, is given in 5.3.3.

Example 4: The requirements here are the same as in Example 3, except that the electrode length is 450 mm [18 in] and the supplemental designator is H4R. The lot classification is as defined in 5.3.2 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.

Table B.7/B.7M 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*. Examples 5 and 5M are for rods and Examples 6 and 6M are 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 (5.3) ^a	_____
B. Level of Testing (6.1 through 6.7) ^a	_____
III. Other Requirements	_____

^a Where specific information is not given (left blank), the requirements of the AWS specification apply (see the Certification and Acceptance clauses in the body and the explanation of each in the annex of the specification invoked in I.B above).

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 (5.1) ^a	_____
B. Level of Testing (6.1 through 6.7) ^a	_____
III. Other Requirements	_____

^a Where specific information is not given (left blank), the requirements of the AWS specification apply (see the Certification and Acceptance clauses in the body and the explanation of each in the annex of the specification invoked in I.B above).

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 (5.2) ^a	_____
B. Level of Testing (6.1 through 6.7) ^a	_____
III. Other Requirements	_____

^a Where specific information is not given (left blank), the requirements of the AWS specification apply (see the Certification and Acceptance clauses in the body and the explanation of each in the annex of the specification invoked in I.B above).

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

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 (5.1 and 5.4) ^a	_____
B. Level of Testing (6.1 through 6.7) ^a	_____
III. Other Requirements	_____

^a Where specific information is not given (left blank), the requirements of the AWS specification apply (see the Certification and Acceptance clauses in the body and the explanation of each in the annex of the specification invoked in I.B above).

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 (5.1) ^b	_____
B. Level of Testing (6.1 through 6.7) ^b	_____
III. Other Requirements	_____

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

^b Where specific information is not given (left blank), the requirements of the AWS specification apply (see the Certification and Acceptance clauses in the body and the explanation of each in the annex of the specification invoked in I.B above).

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 $1200 \pm 25^{\circ}\text{F}$ for 12 hours. The heating and cooling rates above 600°F shall not exceed $200^{\circ}\text{F}/\text{hour}$.			

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

	Examples			
	1	2	3	4
I. General				
A. Quality	450 kg	450 kg	450 kg	450 kg
B. AWS Specification	A5.1M	A5.1M	A5.1M	A5.1M
C. AWS Classification	E4918	E4918	E4918	E4918
D. Supplemental Designators		-1	H4	H4R
E. Diameter	5.0 mm	5.0 mm	5.0 mm	5.0 mm
F. Length	350 mm	350 mm	350 mm	450 mm
G. Unit Package Type and Weight				
1. Carton	25 kg			
2. Can		5 kg	5 kg	5 kg
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. 4M 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 $650 \pm 15^{\circ}\text{C}$ for 12 hours. The heating and cooling rates above 300°C shall not exceed $100^{\circ}\text{C}/\text{hour}$.			

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

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

	Example 5	Example 6
I. General		
A. Quality	200 kg	450 kg
B. AWS Specification	A5.10	A5.10
C. AWS Classification	R4043	ER4043
D. Diameter	2.4 mm	1.2 mm
E. Length	1000 mm	—
F. Unit Package Type and Weight		
1. Spool	—	100 mm, 0.5 kg
2. Coil with Support	—	—
3. Coil without Support	—	—
4. Rim (reel)	—	—
5. Drum	—	—
6. Straight	2 kg	—
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 the Preparation of Technical Inquiries

This annex is not part of AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD), *Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*, 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
550 N.W. LeJeune Road
Miami, FL 33126

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 provi-

sion(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 of Directors' policy requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS stan-

dard 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)

Glossary of Terms Related to Test Reports

This annex is not part of AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD), *Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*, but is included for informational purposes only.

Certificate of Compliance—A statement that the product meets the requirements of the AWS 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.

Certificate of Conformance—A test report documenting that the product meets the requirements of the AWS 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 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 shipped.

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.)

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. These may include:

- Chemical analysis only (per each heat or lot, for the size supplied)—Schedule 3 or H per AWS A5.01, for example.
- Tests listed in Table 2 of AWS A5.01 (per each heat or lot, for the size supplied)—Schedule 4 or I per AWS A5.01, for example.
- 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 A5.01, for example.
- Any additional tests required by the purchaser (per each heat or lot, for the size supplied)—Schedule 6 or K per AWS A5.01, for example.

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.

Typical Test Report (“Typical”)—A nonstandard term which does not have a consistent definition. See Certificate of Compliance or Certificate of Conformance.

Table D.1
Summary of Types of Certificates

Certificate of Compliance	A statement of compliance	
Certificate of Conformance	A statement of compliance	plus results of actual tests of classification requirements on representative material
Certified Material Test Report (CMTR)	A statement of compliance	plus results of actual tests on the material supplied

Annex E (Informative)

List of Deviations from ISO 14344:2002

This annex is not part of AWS A5.01M/A5.01:2008 (ISO 14344:2002 MOD), *Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*, but is included for informational purposes only.

Moved “*Procurement guidelines for consumables*” from end of the title to the beginning of the title.

Replaced Table 2 with table from AWS A5.01

Additional Normative Annex:

Annex A: Quality Assurance

Additional Informative Annexes:

Annex B: Guide to Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes

Annex C: Guidelines for the Preparation of Technical Inquiries

Annex D: Glossary of Terms Related to Test Reports

Annex E: List of Deviations from ISO 14344:2002

Editorial Changes:

Global change: Changed “This international standard” to “This standard” as this is not an international standard after adoption.

Change in Clause 1: Added “AWS,” before “ISO” at several places including two places in Clause 1.

Change in Clause 2:

Changed “reference” to “references”

Changed “document” to “documents” in first sentence

Changed “contains” to “contain” in first sentence

Changed: edition” to “editions”

Changed “applies” to “apply”

Added “subclauses 2.1, 2.2, and 2.3”

Change in subclause 3.4: Added “, braze and braze welding filler metals,” and “is” in the first sentence.

Change in subclause 4.1: Added “, brazing and braze welding filler metals,”

Change in Clause 4.2: Added “, brazing filler metals.”

Change in subclause 4.3: Added “, brazing and braze welding filler metals,” in first sentence.

Change in subclause 5.1: Added “, brazing and braze welding filler metals,”

Changes in subclauses 5.1.1, 5.1.2, 5.1.3, and 5.1.4: Changed “electrodes and rods” to “electrode wires and strips, rods, brazing and braze welding filler metals”

Changes in subclauses 5.1.2, 5.1.4, 5.2.2, 5.2.4, 5.3.2, and 5.3.3: Added “[100 000 lb]”

Changes in subclauses 6.2, 6.3, 6.4, 6.5, 6.6, and 6.7: Added “AWS/” in the second sentence.

Changes in headers for subclauses 6.2, 6.3, 6.4, 6.5, 6.6, and 6.7: Added letters F, G, H, I, J, or K to reconcile with AWS A5.01 terminology.

Clause 7, including subclauses 7.1, 7.2, 7.3, and 7.4, were deleted.

Changes in Table 1: Added letters F, G, H, I, J, or K in first column of table to reconcile with AWS A5.01 terminology.

Modified Table 2 because of the existence of AWS specifications for types of filler materials not covered in Table 2 of ISO 14344, including Titanium, Zirconium, and Brazing materials, and restructured table per the scope of the AWS filler metal specifications.

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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	A5.20	A5.17	A5.25	A5.26	A5.8, A5.31
Low-Alloy Steel	A5.2	A5.5	A5.28	A5.29	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 8249:2000 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>
A5.01M/A5.01 (ISO 14344:2002 MOD)	<i>Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes</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 Electrodes and Rods</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	<i>Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods</i>
A5.11/A5.11M	<i>Specification for Nickel and Nickel-Alloy Welding Electrodes for Shielded Metal Arc Welding</i>
A5.12/A5.12M	<i>Specification for Tungsten and Tungsten-Alloy Electrodes for Arc Welding and Cutting</i>
A5.13	<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	<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	<i>Specification for Bare Electrodes and Rods for Surfacing</i>
A5.22	<i>Specification for Stainless Steel Electrodes for Flux Cored Arc Welding and Stainless Steel Flux Cored Rods for Gas Tungsten Arc Welding</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 Electrode Gas 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>
A5.31	<i>Specification for Fluxes for Brazing and Braze Welding</i>
A5.32/A5.32M	<i>Specification for Welding Shielding Gases</i>
A5.34/A5.34M	<i>Specification for Nickel-Alloy Electrodes for Flux Cored Arc Welding</i>

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