

**ANSI/AWS A5.01-93**  
**An American National Standard**

# **Filler Metal Procurement Guidelines**



**American Welding Society**

**Keywords** — Filler metal, procurement guidelines,  
chemical analysis

**ANSI/AWS A5.01-93**  
**An American National Standard**

**Approved by**  
**American National Standards Institute**  
**December 2, 1992**

## **Filler Metal**

# **Procurement Guidelines**

**Superseding AWS A5.01-87**

Prepared by  
AWS Committee on Filler Metal

Under the Direction of  
AWS Technical Activities Committee

Approved by  
AWS Board of Directors

### **Abstract**

This document provides a means by which the information needed for the procurement of filler metals 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.



**American Welding Society**

550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135

## Statement on Use of AWS Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute. When AWS standards are either incorporated in, or made part of, documents that are included in federal or state laws and regulations, or the regulations of other governmental bodies, their provisions carry the full legal authority of the statute. In such cases, any changes in those AWS standards must be approved by the governmental body having statutory jurisdiction before they can become a part of those laws and regulations. In all cases, these standards carry the full legal authority of the contract or other document that invokes the AWS standards. Where this contractual relationship exists, changes in or deviations from requirements of an AWS standard must be by agreement between the contracting parties.

International Standard Book Number: 0-87171-405-1

American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135

© 1993 by American Welding Society. All rights reserved  
Printed in the United States of America

**Note:** The primary purpose of AWS is to serve and benefit its members. To this end, AWS provides a forum for the exchange, consideration, and discussion of ideas and proposals that are relevant to the welding industry and the consensus of which forms the basis for these standards. By providing such a forum, AWS does not assume any duties to which a user of these standards may be required to adhere. By publishing this standard, the American Welding Society does not insure anyone using the information it contains against any liability arising from that use. Publication of a standard by the American Welding Society does not carry with it any right to make, use, or sell any patented items. Users of the information in this standard should make an independent investigation of the validity of that information for their particular use and the patent status of any item referred to herein.

With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. However, such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

This standard is subject to revision at any time by the AWS Filler Metal Committee. It must be reviewed every five years and if not revised, it must be either reapproved or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS Filler Metal Committee 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 Filler Metal Committee 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, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135.

## Personnel

### AWS Committee on Filler Metal

<i>D. J. Kotecki, Chairman</i>	The Lincoln Electric Company
<i>R. A. LaFave, 1st Vice Chairman</i>	Elliott Company
<i>J. P. Hunt, 2nd Vice Chairman</i>	Inco Alloys International
<i>H. F. Reid, Secretary</i>	American Welding Society
<i>B. Anderson</i>	Alcotec
<i>R. L. Bateman*</i>	Electromanufacturas S A
<i>R. S. Brown</i>	Carpenter Technology Corporation
<i>R. A. Bushey</i>	Alloy Rods Corporation
<i>J. Caprarola, Jr.</i>	Alloy Rods Corporation
<i>L. J. Christensen*</i>	Consultant
<i>R. J. Christoffel</i>	Consultant
<i>D. D. Crockett</i>	The Lincoln Electric Company
<i>R. A. Daemen</i>	Hobart Brothers Company
<i>D. A. DelSignore</i>	Westinghouse Electric Company
<i>H. W. Ebert</i>	Exxon Research and Engineering
<i>S. E. Ferree</i>	Alloy Rods Corporation
<i>D. A. Fink</i>	The Lincoln Electric Company
<i>G. Hallstrom, Jr.</i>	USNRC-RII
<i>R. L. Harris*</i>	R. L. Harris Associates
<i>R. W. Heid</i>	Newport News Shipbuilding
<i>D. C. Helton</i>	Consultant
<i>W. S. Howes</i>	National Electrical Manufacturers Association
<i>R. W. Jud</i>	Chrysler Motors
<i>R. B. Kadiyala</i>	Techalloy Maryland, Incorporated
<i>P. A. Kammer*</i>	Eutectic Corporation
<i>G. A. Kurisky</i>	Maryland Specialty Wire
<i>N. E. Larson</i>	Union Carbide, Industrial Gas Division
<i>A. S. Laurenson</i>	Consultant
<i>G. H. MacShane</i>	MAC Associates
<i>L. M. Malik*</i>	Materials Technology Center
<i>M. T. Merlo</i>	Stoody Company
<i>S. J. Merrick</i>	Teledyne McKay
<i>G. E. Metzger**</i>	AFML
<i>J. W. Mortimer</i>	Consultant
<i>C. L. Null</i>	Department of the Navy
<i>Y. Ogata*</i>	Kobe Steel Limited
<i>J. Payne</i>	Schneider Services International
<i>R. L. Peaslee</i>	Wall Colmonoy Corporation
<i>E. W. Pickering, Jr.</i>	Consultant
<i>M. A. Quintana</i>	General Dynamics Corporation
<i>S. D. Reynolds, Jr.*</i>	Westinghouse Electric PGBU
<i>L. F. Roberts</i>	Canadian Welding Bureau
<i>D. Rozet</i>	Consultant

\* Advisor

\*\* Deceased

**AWS Committee on Filler Metal (Cont)**

<i>P. K. Salvesen</i>	American Bureau of Shipping
<i>H. S. Sayre*</i>	Consultant
<i>O. W. Seth</i>	Chicago Bridge and Iron Company
<i>W. A. Shopp</i>	SAE
<i>M. S. Sierdzinski</i>	Alloy Rods Corporation
<i>R. W. Straiton*</i>	Bechtel Group, Incorporated
<i>R. D. Sutton</i>	L-Tec Welding and Cutting Systems
<i>R. A. Swain</i>	Thyssen Welding Products
<i>J. W. Tackett</i>	Haynes International, Incorporated
<i>R. D. Thomas, Jr.</i>	R. D. Thomas and Company
<i>R. Timerman*</i>	Conarco, S. A.
<i>R. T. Webster</i>	Teledyne Wah Chang
<i>A. E. Wiehe*</i>	Consultant
<i>W. A. Wiehe**</i>	Arcos Alloys
<i>W. L. Wilcox</i>	Consultant
<i>F. J. Winsor*</i>	Consultant
<i>K. G. Wold</i>	Consultant
<i>T. J. Wonder</i>	VSE Corporation

**AWS Subcommittee on Filler Metal Procurement Guidelines**

<i>J. Caprarola, Chairman</i>	Alloy Rods Corporation
<i>H. F. Reid, Secretary</i>	American Welding Society
<i>J. G. Feldstein</i>	Teledyne McKay
<i>D. A. Fink</i>	The Lincoln Electric Company
<i>B. Lawlor</i>	Puget Sound Naval Shipyard
<i>M. T. Merlo</i>	Stoody Company
<i>E. W. Pickering, Jr.</i>	Consultant

\* Advisor

\*\* Deceased

## Foreword

(This Foreword is not part of ANSI/AWS A5.01-93, *Filler Metal Procurement Guidelines*, but is included for information purposes only.)

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 initial version of this document, published in 1978, was the result of work by a task group appointed by the Filler Metal Committee. The 1993 revision was prepared by a permanent subcommittee (the Subcommittee on Filler Metal Procurement Guidelines) which will continue to review specifications in accordance with guidelines of the American National Standards Institute.

AWS A5.01-78          Filler Metal Procurement Guidelines  
ANSI/AWS A5.01-87   Filler Metal Procurement Guidelines

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.

Comments or inquiries concerning this standard are welcome. They should be sent to the Managing Director, Technical Services Division, American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135.

Official interpretations of any of the technical requirements of this standard may be obtained by sending a request, in writing, to the Managing Director, Technical Services Division, American Welding Society. A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

# Contents

	Page No.
<i>Personnel</i> .....	iii
<i>Foreword</i> .....	v
<i>List of Tables</i> .....	vii
1. Scope .....	1
2. Certification .....	1
3. Manufacturer's Quality Assurance System .....	1
4. Definitions and Identification of Materials .....	1
4.1 Introduction .....	1
4.2 Definitions .....	1
4.3 Identification of Consumable Inserts, Brazing and Braze Welding Filler Metal, Solid Electrode Wire, Rods, Strip, Core Wire for Covered Electrodes, and the Sheath (Strip or Tubing) of Composite Electrodes .....	2
4.4 Identification of Covering Mix .....	2
4.5 Identification of Core Ingredients .....	2
5. Lot Classification .....	2
5.1 Covered Electrodes .....	2
5.2 Bare Solid Electrodes and Rods, Brazing and Braze Welding Filler Metal, and Consumable Inserts .....	3
5.3 Flux Cored Electrodes and Metal Cored Electrodes and Rods .....	3
5.4 Flux for Submerged Arc Welding and Brazing and Braze Welding .....	3
6. Level of Testing .....	3
6.1 General Provision .....	3
6.2 Schedule F .....	3
6.3 Schedule G .....	4
6.4 Schedule H .....	4
6.5 Schedule I .....	4
6.6 Schedule J .....	4
6.7 Schedule K .....	4
7. Retest .....	4
8. Supplementary Requirements — Department of Defense .....	4
8.1 Inspection Requirements .....	4
8.2 Alloy Identity .....	6
8.3 Responsibility for Compliance .....	6
<i>Appendix</i> .....	7
A1. Introduction .....	7
A2. General Information .....	7
<i>AWS Filler Metal Specifications and Related Documents</i> .....	(Inside Back Cover)

## List of Tables

Table	Page No.
1 Level of Testing .....	4
2 Schedule I — Required Tests .....	5
A1 Suggested Procurement Detail Form for Covered Electrodes .....	8
A2 Suggested Procurement Detail Form for Bare Solid Electrodes and Rods .....	8
A3 Suggested Procurement Detail Form for Flux Cored and Metal Cored Electrodes and Rods .....	8
A4 Suggested Procurement Detail Form for Submerged Arc Electrodes and Flux and Brazing and Braze Welding Filler Metal .....	9
A5 Suggested Procurement Detail Form for Consumable Inserts .....	9
A6 Example of Use of the Procurement Detail Form for Covered Electrodes .....	10
A7 Example of Use of the Procurement Detail Form for Bare Solid Aluminum Electrodes and Rods .....	10



# Filler Metal

## Procurement Guidelines

### 1. Scope

This document, together with an AWS filler metal specification, is intended to describe a uniform method for providing those specific details needed for filler metal procurement which consist of the following:

- (1) The filler metal classification (selected from the pertinent AWS filler metal specification)
- (2) The lot classification (selected from Section 5 of this document)
- (3) The level of testing schedule (selected from Table 1 and Section 6, Level of Testing, of this document)

### 2. Certification

By affixing the AWS specification and classification designations to the packaging, or the classification to the product, the manufacturer certifies that the product meets the requirements of that specification.

### 3. Manufacturer's Quality Assurance System

**3.1** 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.

**3.2** It is the responsibility of the purchaser to review the quality assurance program of the manufacturer for conformance to the purchaser's specific requirements.

**3.3** In the case of distributors who receive electrodes in bulk and package them for distribution, or who repackage under their own label, the distributor shall maintain an adequate control system to ensure that the package contents are traceable to the original manufacturer's records.

### 4. Definitions and Identification of Materials

**4.1 Introduction.** In production, the components of the filler metal 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, however, 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 employed in producing the filler metal. This designation stays with the filler metal and can be used to identify the material later, in those cases in which identification is necessary.

**4.2 Definitions.** The terms *dry batch*, *dry blend*, *wet mix*, and *heat*, as they are defined and used in this document, refer to discrete quantities of the components used in producing a *lot* of filler metal. The definition of these terms and the considerations that must be given to the identification of the components to which they apply are as follows.

**4.2.1 Dry Batch.** A dry batch is the quantity of dry ingredients mixed at one time in one mixing vessel.

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

**4.2.2 Dry Blend.** A dry blend consists of two or more dry batches from which quantities of each are combined proportionately, then mixed in a mixing vessel. This produces 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. 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.

**4.2.3 Wet Mix.** A wet mix is the combination of liquid binder and a dry batch or a dry blend, or a portion thereof, mixed at one time in one mixing vessel.

**4.2.4 Heat.** A heat of metal 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 composite electrode wire and rod) is defined by one of the following, depending on the method of melting and refining of the metal.

**4.2.4.1** Where slag-metal or gas-metal reactions occur in producing the metal (e.g., open hearth, electric arc, basic oxygen, argon-oxygen), a heat is the material obtained from one furnace melt.

**4.2.4.2** Where significant chemical reactions do not occur in producing the metal (e.g., induction melting in a controlled atmosphere or in a vacuum), a heat is 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 shall conform to the chemical composition range approved by the purchaser of the material (i.e., the producer of the filler metal).

**4.2.4.3** In processes involving continuous melting and casting (e.g., consumable electrode remelt), a heat is 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 in 4.2.4.1 or 4.2.4.2. Each remelt shall conform to the chemical composition range approved by the purchaser of the material (i.e., the producer of the filler metal).

### **4.3 Identification of Consumable Inserts, Brazing and Braze Welding Filler Metal, Solid Electrode Wire, Rods, Strip, Core Wire for Covered Electrodes, and the Sheath (Strip or Tubing) of Composite Electrodes**

**4.3.1 Heat Number.** Solid wire, electrode core wire, rod, strip, consumable inserts, and brazing filler metals

identified by heat number shall consist of material from a single heat of metal.

**4.3.2 Controlled Chemical Composition.** Solid wire, electrode core wire, rod, strip, consumable inserts, and brazing and braze welding filler metal 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.<sup>1</sup> The results of the analysis of each sample must 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 must be sampled on both ends and shall have no more than a single splice per coil.

### **4.4 Identification of Covering Mix**

**4.4.1 Wet Mix.** Covering identified by wet mix shall consist of a single wet mix for each lot of electrodes.

**4.4.2 Controlled Chemical Composition.** Covering identified by controlled composition (rather than by wet mix) shall consist of one or more wet mixes and shall be subjected to sufficient tests, both before and after it has been applied to the core wire, to assure that all wet mixes within the lot are equivalent. These tests shall include chemical analysis, the results of which must fall within the manufacturer's acceptance limits. The identification of the test procedure and the results of the tests shall be recorded.

### **4.5 Identification of Core Ingredients**

**4.5.1 Dry Blend.** Core ingredients identified by dry blend shall consist of a single dry batch or dry blend.

**4.5.2 Controlled Chemical Composition.** Core ingredients identified by controlled composition consist of one or more dry blends and shall 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 must 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 Covered Electrodes**

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

1. Analysis of coils is not required for aluminum or deoxidized copper filler metal.

**5.1.2 Class C2.** A Class C2 lot of covered electrodes is the quantity, not exceeding 100 000 lbs (45 350 kg), of any one size and classification produced in 24 hours of consecutively scheduled production (i.e., consecutive normal work shifts).

**5.1.3 Class C3.** A Class C3 lot of covered electrodes is the quantity, not exceeding 100 000 lbs (45 350 kg), of any one size and classification produced in 24 hours of consecutively scheduled production (i.e., consecutive normal work shifts). Class C3 electrodes shall be produced from covering identified by wet mix (4.4.1) or controlled chemical composition (4.4.2) and core wire identified by heat number (4.3.1) or controlled chemical composition (4.3.2).<sup>2</sup>

**5.1.4 Class C4.** A Class C4 lot of covered electrodes is the quantity of any one size and classification produced from one wet mix (4.4.1) and one heat of core wire (4.3.1).<sup>3</sup>

**5.1.5 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 and one heat of core wire (4.3.1).

## **5.2 Bare Solid Electrodes and Rods, Brazing and Braze Welding Filler Metal, and Consumable Inserts**

**5.2.1 Class S1.** A Class S1 lot of bare solid electrodes and rods, brazing and braze welding filler metal, and consumable inserts is the manufacturer's standard lot, as defined in the manufacturer's quality assurance program.

**5.2.2 Class S2.** A Class S2 lot of bare solid electrodes and rods, brazing and braze welding filler metal, and consumable inserts is the quantity, not exceeding 100 000 lbs (45 350 kg), of one classification, size, form, and temper produced in 24 hours of consecutively scheduled production (i.e., consecutive normal work shifts). Class S2 electrodes shall be produced from one heat (4.3.1) or from material identified by controlled chemical composition (4.3.2).

**5.2.3 Class S3.** A Class S3 lot of bare solid electrodes and rods, brazing and braze welding filler metal, and consumable inserts is the quantity of one size produced in one production cycle from one heat.

**5.2.4 Class S4.** A Class S4 lot of bare solid electrodes and rods, brazing and braze welding filler metal, and consumable inserts is the quantity, not exceeding 100 000 lbs (45 350 kg), of one classification, size, form,

and temper produced under one production schedule. Class S4 electrodes shall be produced from one heat (4.3.1) or from material identified by controlled chemical composition (4.3.2).

## **5.3 Flux Cored Electrodes and Metal Cored Electrodes and Rods**

**5.3.1 Class T1.** A Class T1 lot of flux cored electrodes, or metal cored electrodes and rods, is the manufacturer's standard lot, as defined in the manufacturer's quality assurance program.

**5.3.2 Class T2.** A Class T2 lot of flux cored electrodes, or metal cored electrodes and rods, is the quantity, not exceeding 100 000 lbs (45 350 kg), of one classification and size produced in 24 hours of consecutively scheduled production (i.e., consecutive normal work shifts). Class T2 electrodes shall be produced from tube or strip identified by heat number (4.3.1) or by controlled chemical composition (4.3.2). Identification of the core ingredients shall be as specified in 4.5.1 or 4.5.2.

**5.3.3 Class T3.** A Class T3 lot of flux cored electrodes, or metal cored electrodes and rods, is the quantity produced from one heat (4.3.1) and one dry batch or one dry blend of core materials. Identification of the core ingredients shall be as specified in 4.5.1.

**5.3.4 Class T4.** A Class T4 lot of flux cored electrodes, or metal cored electrodes and rods, is the quantity, not exceeding 100 000 lbs (45 350 kg), of one classification and size produced under one production schedule from tube or strip identified by heat number (4.3.1) or controlled chemical composition (4.3.2). Identification of the core ingredients shall be as specified in 4.5.1 or 4.5.2.

## **5.4 Flux for Submerged Arc Welding and Brazing and Braze 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 program.

**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 Provision.** The level of the testing schedule shall be selected by the purchaser from those listed in Table 1.

**6.2 Schedule F.** The level of testing shall be the manufacturer's standard. The statement, "The product supplied shall meet the requirements of the applicable AWS

2. For metal cored covered electrodes, Class T2 core wire shall be used (see 5.3.2).

3. For metal cored covered electrodes, Class T3 core wire shall be used (see 5.3.3).

**Table 1**  
**Level of Testing**

Schedule	Section Requirements	Reference
F <sup>a</sup>	The manufacturer's standard testing level	6.2
G	Tests of material from any production run of the product within the 12 months preceding the date of purchase order	6.3
H	Chemical analysis only, for each lot shipped	6.4
I	Tests called for in Table 2, for each lot shipped	6.5
J	All classification tests called for in the AWS filler metal specification, for each lot shipped	6.6
K <sup>b</sup>	All tests specified by the purchaser, for each lot shipped	6.7

**Notes:**

- a. This schedule will apply automatically if a specific schedule is not designated.
- b. Some additional tests may be found in Section 8, Supplementary Requirements.

filler metal specification, when tested in accordance with that specification" and a summary of the typical properties of the material, when tested in that manner, shall be supplied upon written request. The lot classification will be the manufacturer's standard.

**6.3 Schedule G.** A Certified Report of Tests shall be supplied for material from any production run of the product made within the twelve months preceding the date of the purchase order. This will include the results of all tests prescribed for that classification in the AWS specification. For nonferrous material identified by controlled composition, certification of conformance to the chemical composition limits of the lot shall be supplied. The lot classification is the manufacturer's standard.

**6.4 Schedule H.** Chemical analysis of each lot shipped shall be supplied by the manufacturer. The analysis will include those elements prescribed for that classification in the AWS specification. For nonferrous material identified by controlled composition, certification of conformance to the chemical composition limits of the lot shall be supplied. The lot classification shall be specified by the purchaser from those listed in Section 5, Lot Classification, of this document.

**6.5 Schedule I.** A Certified Report of 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 consumable certification; however, they do not necessarily include all tests required for Schedule J. The tests shall be performed as prescribed for that classification in the AWS specification. For nonferrous material identified by controlled composition, certification of conformance to the chemical composition limits of the lot shall be supplied. The lot classification shall be specified by the purchaser from those listed in Section 5, Lot Classification, of this document.

**6.6 Schedule J.** A Certified Report of Tests required for that classification in the AWS specification shall be supplied by the manufacturer for each lot shipped. For nonferrous material identified by controlled composition, certification of conformance to the chemical composition limits of the lot shall be supplied. The lot classification shall be specified by the purchaser from those listed in Section 5, Lot Classification, of this document.

**6.7 Schedule K.** In addition to, or in place of, any of the tests called for in the applicable AWS specification, the purchaser may require other tests such as testing after a specified heat treatment or alloy identity procedures (see Section 8, Supplementary Requirements, for detailed alloy identity procedures). In all such cases, the purchaser shall identify on the purchase order the specific tests that are to be conducted, the procedures to be employed, and the requirements that must be met. The lot classification shall be specified by the purchaser from those listed in Section 5, Lot Classification, of this document.

## 7. Retest

If any test fails to meet its requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Specimens or samples for retest may be taken from the original test assembly or sample, or from one or two new test assemblies or samples. For chemical analysis, the retest need be only for those specific elements that failed to meet their requirement.

## 8. Supplementary Requirements— Department of Defense

**8.1 Inspection Requirements.** Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection requirements (examinations and tests) as specified in Schedule K, Table 1, herein. Except as otherwise specified in the contract or purchase order, the manufacturer

**Table 2**  
**Schedule I — Required Tests<sup>a, b, c</sup>**

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 <sup>d</sup>	(A5.5) 1,2,3,4,5 <sup>d</sup>	(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, and EGV	(A5.18) (A5.26) 1,2,4 1,2,3,4	(A5.26) (A5.28) 1,2,3,4 1,2,4	(A5.9) 1	(A5.14) 1	(A5.13) 1 (A5.21) <sup>e</sup> 1	(A5.15) 1	(A5.10) 1,4 <sup>f</sup> ,9 <sup>f</sup>	(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 EGV	(A5.20) (A5.26) 1,2,3,4 1,2,3,4	(A5.26) (A5.29) 1,2,3,4 1,2,3,4	(A5.22) 1	—	—	(A5.15) 1	—	—	—	—	—	—
Solid or Metal Cored Electrode — Flux Combinations for SAW and ESW	(A5.17) (A5.25) 1,2,3,4 1,2,3,4	(A5.23) (A5.25) 1,2,3,4 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	(A5.27) 1	(A5.19) 1	—	—	—
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) 1,7
Brazing Metal Powders	—	—	—	—	—	—	—	—	—	—	—	(A5.8) 1,8

**Notes:**

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. Electrodes used for SMAW

f. Test 4 — for electrodes

Test 9 — for rods

may use "in-house" facilities or others deemed suitable for the performance of the inspection requirements specified herein, unless disapproved by the customer. The customer reserves the right to perform any of the inspections set forth in this specification, where such inspections are deemed necessary, to ensure supplies and services conform to prescribed requirements.

**8.1.1 Classification of Inspections.** The inspection requirements specified herein are classified as follows:

- (a) Qualification inspection
- (b) Quality conformance inspection

**8.1.2 Inspection Conditions.** Unless otherwise specified, all inspections shall be performed in accordance with the conditions specified herein and environmental conditions shall be ambient laboratory conditions.

**8.1.3 Qualification Inspection.** Qualification inspection shall be conducted at a laboratory satisfactory to the customer. The inspection shall consist of the examinations and tests specified in the procurement documents. The manufacturer shall provide and maintain an inspection system acceptable to the customer for supplies and services covered by this specification.

**8.2 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, or a combination of methods. When required, alloy identity procedures shall be specified in Procurement Detail Forms using Item III, Other Requirements.<sup>4</sup>

4. See Tables A1 through A7 (in the Appendix) for Procurement Detail Forms and examples of their use.

**8.2.1 Core Wire Alloy Identity.** Each end of rod, wire, or strip to be spliced during processing shall be tested for alloy identity just prior to splicing at the process station, except when splicing is done to repair a wire break without removing the wire from the process line. Both ends of each coil drawn to finish size shall be tested for alloy identity prior to cutting into electrode core wire lengths.

**8.2.1.1 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.

**8.2.1.2 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.

**8.3 Responsibility for Compliance.** All items shall meet all applicable requirements. The inspections set forth in this specification shall become a part of the manufacturer's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the customer to accept defective material.

## Appendix

# Guide to AWS Filler Metal Procurement Guidelines

(This Appendix is not a part of ANSI/AWS A5.01-93, *Filler Metal Procurement Guidelines*, but is included for information only.)

### A1. 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 A5.01, *Filler Metal Procurement Guidelines*.

### A2. 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 filler metal specifications 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 A1 through A5 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).

Examples of the manner in which the Procurement Detail Forms might be used are given in Tables A6 and

A7. In Table A6, 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 pounds (453 kg) of 3/16 in. (4.8 mm) 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 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 5.1.1).

**Example 3:** Requirements include 10 lb unit packages, an H4 supplemental designator, and, for the lot shipped, a certificate showing the results of all tests ANSI/AWS A5.1 requires for the classification of E7018 electrodes. The definition of the lot classification, in this case, is given in 5.1.3.

**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 5.1.2 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  $1200 \pm 25^\circ\text{F}$  ( $650 \pm 15^\circ\text{C}$ ) for 12 hours with the heating and cooling rates specified in Item III, Other Requirements.

Table A7 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 ANSI/AWS A5.10, *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 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 A1**  
**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 (5.1)*	_____
B. Level of Testing (6.1 through 6.7)*	_____
III. Other Requirements	
_____	

\* 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 Appendix of the specification invoked in IB above).

**Table A2**  
**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 (5.2)*	_____
B. Level of Testing (6.1 through 6.7)*	_____
III. Other Requirements	
_____	

\* 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 Appendix of the specification invoked in IB above).

**Table A3**  
**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 (5.3)*	_____
B. Level of Testing (6.1 through 6.7)*	_____
III. Other Requirements	
_____	

\* 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 Appendix of the specification invoked in IB above).



**Table A4**  
**Suggested Procurement Detail Form**  
**for Submerged Arc Electrodes and**  
**Flux and Brazing and Braze Welding**  
**Filler Metal**

	Electrode	Flux
<b>I. General</b>		
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	_____	_____
<b>II. Certification and Testing</b>		
A. Lot Classification (5.2 and 5.4)*	_____	_____
B. Level of Testing (6.1 through 6.7)*	_____	_____
<b>III. Other Requirements</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 Appendix of the specification invoked in IB above).

**Table A5**  
**Suggested Procurement Detail Form**  
**for Consumable Inserts**

<b>I. General</b>	
A. Quantity*	_____
B. AWS Specification	_____
C. AWS Classification	_____
D. Shape (Class)	_____
E. Style	_____
F. Size	_____
<b>II. Certification and Testing</b>	
A. Lot Classification (5.2) <sup>b</sup>	_____
B. Level of Testing (6.1 through 6.7) <sup>b</sup>	_____
<b>III. Other Requirements</b>	_____

**Notes:**

- a. Number of pieces or 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 Appendix of the specification invoked in IB above).

**Table A6**  
**Example of Use of the Procurement Detail Form for Covered Electrodes**

	Examples			
	1	2	3	4
I. General				
A. Quantity	<u>1000 lbs</u>	<u>1000 lbs</u>	<u>1000 lbs</u>	<u>1000 lbs</u>
B. AWS Specification	<u>A5.1</u>	<u>A5.1</u>	<u>A5.1</u>	<u>A5.1</u>
C. AWS Classification	<u>E7018</u>	<u>E7018</u>	<u>E7018</u>	<u>E7018</u>
D. Supplemental Designators		<u>-1</u>	<u>H4</u>	<u>H4R</u>
E. Diameter	<u>3/16 in.</u>	<u>3/16 in.</u>	<u>3/16 in.</u>	<u>3/16 in.</u>
F. Length	<u>14 in.</u>	<u>14 in.</u>	<u>14 in.</u>	<u>18 in.</u>
G. Unit Package Type and Weight				
1. Carton	<u>50 lb</u>			
2. Can		<u>10 lb</u>	<u>10 lb</u>	<u>10 lb</u>
3. Other				
II. Certification and Testing				
A. Lot Classification	<u>C1</u>	<u>C1</u>	<u>C3</u>	<u>C2</u>
B. Level of Testing	<u>Schedule F</u>	<u>Schedule I</u>	<u>Schedule J</u>	<u>Schedule K</u>
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 $600^\circ \text{F}$ shall not exceed $200^\circ \text{F}/\text{hour}$ .			

**Table A7**  
**Example of Use of the Procurement Detail Form  
for Bare Solid Aluminum Electrodes and Rods**

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

## AWS Filler Metal Specifications and Related Documents

<b>AWS Designation</b>	<b>Title</b>
FMC	Filler Metal Comparison Charts
A4.2	Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Austenitic-Ferritic Stainless Steel Weld Metal
A4.3	Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding
A5.01	Filler Metal Procurement Guidelines
A5.1	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
A5.2	Specification for Carbon and Low Alloy Steel Rods for Oxyfuel Gas Welding
A5.3	Specification for Aluminum and Aluminum Alloy Electrodes for Shielded Metal Arc Welding
A5.4	Specification for Stainless Steel Welding Electrodes for Shielded Metal Arc Welding
A5.5	Specification for Low Alloy Steel Covered Arc Welding Electrodes
A5.6	Specification for Covered Copper and Copper Alloy Arc Welding Electrodes
A5.7	Specification for Copper and Copper Alloy Bare Welding Rods and Electrodes
A5.8	Specification for Filler Metals for Brazing and Braze Welding
A5.9	Specification for Bare Stainless Steel Welding Electrodes and Rods
A5.10	Specification for Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods
A5.11	Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding
A5.12	Specification for Tungsten and Tungsten Alloy Electrodes for Arc Welding and Cutting
A5.13	Specification for Solid Surfacing Welding Rods and Electrodes
A5.14	Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods
A5.15	Specification for Welding Electrodes and Rods for Cast Iron
A5.16	Specification for Titanium and Titanium Alloy Welding Electrodes and Rods
A5.17	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
A5.18	Specification for Carbon Steel Filler Metals for Gas Shielded Arc Welding
A5.19	Specification for Magnesium Alloy Welding Electrodes and Rods
A5.20	Specification for Carbon Steel Electrodes for Flux Cored Arc Welding
A5.21	Specification for Composite Surfacing Welding Rods and Electrodes
A5.22	Specification for Flux Cored Corrosion-Resisting Chromium and Chromium-Nickel Steel Electrodes
A5.23	Specification for Low Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
A5.24	Specification for Zirconium and Zirconium Alloy Welding Electrodes and Rods
A5.25	Specification for Carbon and Low Alloy Steel Electrodes and Fluxes for Electroslag Welding
A5.26	Specification for Carbon and Low Alloy Steel Electrodes for Electrogas Welding
A5.27	Specification for Copper and Copper Alloy Rods for Oxyfuel Gas Welding
A5.28	Specification for Low Alloy Steel Filler Metals for Gas Shielded Arc Welding
A5.29	Specification for Low Alloy Steel Electrodes for Flux Cored Arc Welding
A5.30	Specification for Consumable Inserts
A5.31	Specification for Fluxes for Brazing and Braze Welding

For ordering information, contact the Order Department, American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135. Phone: 1-800-334-9353.