

Specification for Classification of Weld-Through Paint Primers



American Welding Society



AWS D3.9:2010
An American National Standard

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American National Standards Institute
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Specification for Classification of Weld-Through Paint Primers

1st Edition

Prepared by the
American Welding Society (AWS) D3 Committee on Welding in Marine Construction

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification prescribes the requirements for the classification of weld-through paint primers. The classification is based on paint film thickness and welding procedure. Manufacturers may classify their products to different film thicknesses or welding procedures if they provide the details of their tests.



American Welding Society

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Foreword

This foreword is not part of AWS D3.9:2010, *Specification for Classification of Weld-Through Paint Primers*, but is included for informational purposes only.

In 1996, the AWS Committee on Welding in Marine Construction established a Subcommittee on Weld-Through Paint Primers and requested that they develop a standard to classify weld-through paint primers. This document is the first edition of the standard.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS D3 Committee on Welding in Marine Construction, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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Introduction

Industries, notably shipbuilding firms, have introduced weld-through paint primers in plate and shape fabrication lines in order to increase productivity. The ability to weld directly through these coatings permits reductions in construction costs and improvements in schedule times.

An obstacle to the immediate introduction of this technology into the welding operations has been the inconsistent quality of welds deposited on the primed base metal. By using a standard test procedure to classify weld-through paint primers, potential users will be able to determine the baseline levels of painting and welding required for their applications and to specify these requirements to their coating supplier.

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Specification for Classification of Weld-Through Paint Primers

1. Scope

1.1 This standard specifies the requirements for the classification of weld-through paint primers only. The paint primers are classified based on the maximum coating thickness for successful welding and the welding procedure used during the classification test. This Standard provides a system for paint manufacturers to classify the weldability features of weld-through paint primers. This Standard is limited to weld-through paint primers only and does not include galvanized or other types of protective coatings.

1.2 This standard makes sole use of the U.S. Customary units. Approximate mathematical equivalents in the International System of Units (SI) are provided for comparison in parentheses or in appropriate columns in tables and figures.

1.3 This Standard is not a safety document. Safety and health issues and concerns are beyond the scope of this standard, and therefore are not fully addressed herein. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, and applicable federal and state regulations.

The application of coatings and subsequent processing of coated products should observe safety and health precautions in the country-specific and supplier-specific Material Safety Data Sheets (MSDS) for each coating.

In addition to ANSI Z49.1, the AWS also publishes Safety and Health Fact Sheets.¹ These fact sheets are listed in Annex C.

Employers are also referred to the US Department of Labor Regulations. Particular reference is made to OSHA **Shipyard Employment Standard** 29CFR1915.53,² *Welding, Cutting and Heating in Way of Preservative Coatings* and OSHA **Construction Regulation** 29CFR1926.354, *Welding, Cutting, and Heating in Way of Preservative Coatings*.

2. Normative References

The following standards contain provisions which, through reference in this text, constitute mandatory provisions of this AWS Standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

ASTM Documents³:

ASTM A36/A36M, *Standard Specification for Carbon Structural Steel*

ASTM A131/A131M, *Standard Specification for Structural Steel for Ships*

ASTM D1186, *Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base*

ASTM D4417, *Field Measurement of Surface Profile of Blast Cleaned Steel*

¹ AWS standards are published by the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

² Code of Federal Regulations (CFR) standards are published by the U.S. Government Printing Office, 732 N. Capitol Street, NW, Washington, DC 20401.

³ ASTM standards are published by the ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

AWS Documents⁴:

- AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*
- AWS A3.0, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*
- AWS A5.1/A5.1M, *Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding*
- AWS A5.17/A5.17M, *Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding*
- AWS A5.18/A5.18M, *Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding*
- AWS A5.20/A5.20M, *Carbon Steel Electrodes for Flux Cored Arc Welding*
- AWS A5.32/A5.32M, *Specification for Welding Shielding Gases*
- AWS B4.0, *Standard Methods for Mechanical Testing of Welds*
- ANSI Z49.1, *Safety in Welding, Cutting and Allied Processes*.

NACE Documents⁵:

- NACE No. 2/SSPC-SP 10, *Joint Surface Preparation Standard: Near-White Metal Blast Cleaning*

SSPC Documents⁶:

- SSPC PA 2, *Measurement of dry coating thickness with magnetic gages*
- SSPC-SP10, *Near-white blast cleaning/surface preparation*

3. Terms and Definitions

Terms used in this document shall be interpreted in accordance with AWS A3.0, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*, except for those not defined by that standard or where these terms require further definition to clarify their usage in this standard.

4. Test Procedure

4.1 The base material shall be ASTM A36/A36M, ASTM A131/A131M, or equivalent.

4.2 All surfaces shall be blast-cleaned in accordance with SSPC-SP 10/NACE No. 2, *Near-White Blast Cleaning*, with a surface profile of 1.5–2.5 mils (38–64 microns). The surface profile shall be measured using a profile comparator (ASTM D4417, Method A), a profile depth gage (ASTM D4417, Method B), or a replica tape (ASTM D4417, Method C).

4.3 Following preparation, and attachment of shims (see 4.5), all surfaces shall be spray painted as uniformly as possible with the primer to obtain the required dry film thickness. In order to simulate welding of sections which have the bottom edge of the vertical piece primed, some tests may be carried out with the primer applied at double the required dry film thickness on side C, as shown in Figure 1. Where all tests qualifying a particular primer were performed on assemblies with double the required film thickness on side C, the suffix “-2T” may be added to the classifications listed in 5.2.

4.4 Prior to weld testing, the primer-coated plates shall be allowed to dry in accordance with the manufacturer’s recommendations.

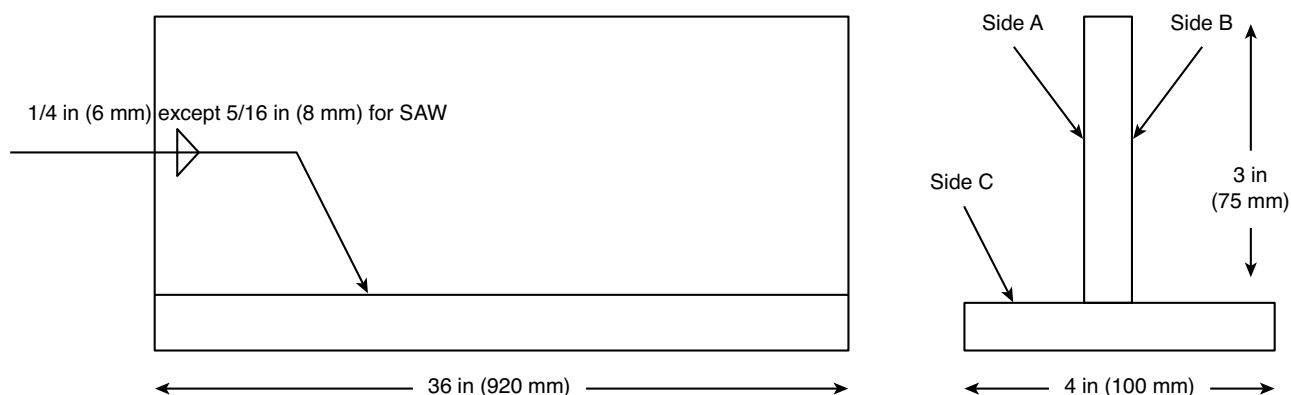
4.5 Prior to spraying the shop primer, four steel shims shall be attached to each surface, sides A, B, and C in Figure 1, in areas that will not interfere with the welding test. The locations shall be equally spaced along the length of each of the three surfaces. Bare substrate readings of the steel shims shall be taken prior to spraying using a Type 2 electromagnetic induction dry film gage in accordance with SSPC PA2. The dry film thickness of the paint shall be measured and the difference in the two readings recorded. The coating thickness measurement of each shim shall consist of the average of three individual gage readings within 1 in (25 mm) of each other. A total of 12 measurements per assembly shall be made.

The 12 values shall be recorded on the test report data sheet.

⁴ AWS standards are published by the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

⁵ NACE standards are published by the NACE International, 1440 South Creek Drive, Houston, TX 77084–4906

⁶ SSPC standards are published by the SSPC, 40 24th Street, 6th Floor, Pittsburgh, PA 15222.



Notes:

1. The plate shall be 3/8 in (10 mm) thick ASTM A36/A36M or ASTM A131/A131M steel or equivalent.
2. Prior to assembly, the bottom edge of the vertical plate shall be ground or milled to remove paint buildup at the corners to be welded.
3. The vertical plate shall be fit tight against the horizontal plate.
4. The welding position shall be horizontal (2F).
5. Two 20 in (500 mm) long assemblies may be substituted for one 36 in (920 mm) assembly.
6. The tolerance on the size of the fillet weld is $-1/16$ in (1.6 mm), +0.

Figure 1—Test Assembly for Classification of Weld-Through Paint Primers

If the dry film thickness of side C is not doubled as permitted in 3.2, the average of these twelve readings shall be considered the primer thickness for purposes of qualification. If the dry film thickness of side C is doubled as permitted in 3.2, the primer thickness for purposes of qualification shall be calculated as follows:

$$(A+B+C/2)/3$$

If test pieces are cut from a larger plate primed on an automated spray line, the dry film thickness on each plate surface that forms sides A, B, and C in Figure 1 shall be measured using an appropriate method, such as SSPC-PA2 or ASTM D1186.

4.6 Prior to assembly of the pieces as shown in Figure 1, the bottom edge of the vertical plate shall be machined smooth by grinding or milling, as shown in Figure 1. The pieces shall be assembled as shown in Figure 1, making sure to obtain a tight fit along the length of the part. The gap between the pieces shall not exceed 1/32 in (0.8 mm). Excessive gap may be corrected by clamping. Tack welds shall be small and as few as possible.

4.7 Using one of the welding procedures contained in Annex A of this document, complete the two (2) fillet welds in the horizontal (2F) position. The same procedure shall be used for both welds. The fillet welds shall be deposited one side at a time.

4.8 Completely remove the first side fillet weld by mechanical process, arc gouging, or oxygen gouging.

4.9 A fillet-weld-break test on the second side fillet weld shall be performed in accordance with AWS B4.0. The test assembly may be cut into shorter lengths to facilitate fracture.

4.10 When examining the weld quality, 2 in (50 mm) at the start and 2 in (50 mm) at the end of each test piece shall be excluded.

5. Inspection

5.1 Prior to gouging and performing the fillet-weld-break test, the welds shall be visually examined without the use of magnification. Any surface cracks discovered on visual inspection shall be a cause for rejection.

5.2 After gouging and performing the fillet-weld-break test, the fracture surfaces shall be visually examined.

5.3 The weld shall be considered acceptable provided the visual examination of the fracture surfaces reveals:

1. complete fusion to the root;
2. no cracks;
3. no indication (porosity, slag, or other inclusion) larger than 3/32 in (2.4 mm);
4. the sum of relevant porosity indications (larger than 1/32 in (0.8 mm)) is less than 10% of the total length of the inspected weld (32 in (813 mm)); and
5. the sum of relevant porosity indications (larger than 1/32 in (0.8 mm)) is less than 1/4 in (6 mm) in any measured one-inch length of the weld.

6. Classification

6.1 The coating shall be classified as a weldable primer upon satisfactory completion of the testing described herein.

6.2 The manufacturer may identify the product as conforming to one or more of the following classifications:

1. A-1
2. A-2
3. A-3
4. A-4
5. A-5
6. A-6
7. B-1
8. B-2
9. B-3
10. B-4
11. B-5
12. B-6

Where the letter identifies the maximum primer thickness tested, as defined in Table 1, and the number identifies the welding procedure used as shown in Annex A.

For example, Classification A-1 indicates that the coating conforms to primer classification A-1 as per AWS D3.9 when tested with Brand XYZ electrode. The manufacturer's report (see 7.1) includes the filler metal and flux trade name(s) used for testing. Filler metals and fluxes of other trade names may give different test results. Also, see 8.3.

Table 1
Primer Thickness Classifications

CLASS	THICKNESS mils (μm) ^a
A	0.5–1.0 (12–25)
B	>1.0–1.5 (26–38)

^a The primer thickness shall be the average value as measured in accordance with Clause 4.

6.3 The coating manufacturer may also classify a product as X-Y, where X indicates a primer thickness different from those shown in Table 1 and Y indicates that an alternate welding procedure was used for testing. It is the responsibility of the manufacturer to provide the details of these tests upon request of the buyer.

7. Test Report

7.1 The following items shall be included on the Manufacturer's classification test report:

1. Paint manufacturer's name;
2. Paint trade name;
3. Date of manufacture of paint used for the test;
4. Name of manufacturer and trade name of welding consumable used for certification testing.
5. Date of classification test;
6. Thickness of primer in classification test assembly calculated, as indicated in 4.5;
7. Welding Procedure number in accordance with Annex A;
8. Filler metal and flux (for submerged arc welding) trade name;
9. Lowest hydrogen designator for which filler metal can be classified, as defined by the applicable AWS filler material specification;
10. Welding travel speed for classification test;
11. Actual weld size;
12. Visual inspection results; and
13. Fillet-weld-break test results.

8. Certification

8.1 By affixing the AWS classification designations and expiry date for the primer to the container of the weld-through-paint primer, the manufacturer certifies that the product meets the requirements of this specification.

8.2 Certification to this standard will extend for 12 months from the date of performance of the tests, as described in Clause 4.

8.3 The only testing requirements implicit in the certification are that the manufacturer has actually conducted the tests required by the specification on material that is representative of that being shipped and that the material met the requirements of the specification. The representative material, in this case, is any production run of that classification using the same formulation. "Certification" is not to be construed to mean that tests of any kind were necessarily conducted on samples of the specific material shipped.

9. Renewal of Certification

9.1 Renewal of certification may be obtained by performing the required tests before the expiration of the 12-month certification period.

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Annex A (Normative) Welding Procedures

This annex is part of AWS D3.9:2010, *Specification for Classification of Weld-Through Paint Primers*, and includes mandatory elements for use with this standard.

WELDING PROCEDURE 1

PROCESS: Shielded Metal Arc (SMAW)

FILLER MATERIAL: AWS A5.1/A5.1M, E7018

DIAMETER: 1/8 in (3.2 mm)

SHIELDING GAS: Not applicable

AMPERAGE: 120–130 A

VOLTAGE: 22–24 V (suggested)

POLARITY: direct current electrode positive (dcep)

PREHEAT: None permitted

NOMINAL FILLET WELD SIZE: 1/4 in (6 mm)

WELDING PROCEDURE 2

PROCESS: Flux Cored Arc (FCAW)

FILLER MATERIAL: AWS A5.20/A5.20M, E71T-1C

DIAMETER: 0.052 in (1.3 mm)

SHIELDING GAS: CO₂
AWS A5.32/A5.32M, SG-C
Flow Rate: 45 CFH (21 liters/minute) minimum

AMPERAGE: 155–170 A

VOLTAGE: 26–28 V

POLARITY: direct current electrode positive (dcep)

PREHEAT: None permitted

NOMINAL FILLET WELD SIZE: 1/4 in (6 mm)

WELDING PROCEDURE 3

PROCESS: Flux Cored Arc (FCAW)

FILLER MATERIAL: AWS A5.20/A5.20M, E71T-1M

DIAMETER: 0.045 in (1.1 mm)

SHIELDING GAS: 75% Argon/25% CO₂
AWS A5.32/A5.32M, SG-AC-25
Flow Rate: 45 CFH (21 liters/minute) minimum

AMPERAGE: 140–160 A

VOLTAGE: 26–28 V

POLARITY: direct current electrode positive (dcep)

PREHEAT: None permitted

NOMINAL FILLET WELD SIZE: 1/4 in (6 mm)

WELDING PROCEDURE 4

PROCESS: Flux Cored Arc (FCAW) – Mechanized

FILLER MATERIAL: AWS A5.20/A5.20M, E71T-1M

DIAMETER: 1/16 in (1.6 mm)

SHIELDING GAS: 75% Argon/25% CO₂
AWS A5.32/A5.32M, SG-AC-25
Flow Rate: 45 CFH (21 liters/minute) minimum

AMPERAGE: 250–280 A

VOLTAGE: 25–27 V

POLARITY: direct current electrode positive (dcep)

PREHEAT: None permitted

NOMINAL FILLET WELD SIZE: 1/4 in (6 mm)

WELDING PROCEDURE 5

PROCESS: Gas Metal Arc (GMAW)

FILLER MATERIAL: AWS A5.18/A5.18M, ER70S-3

DIAMETER: 0.045 in (1.1 mm)

SHIELDING GAS: 95% Argon/5% CO₂
AWS A5.32/A5.32M, SG-AC-5
Flow Rate: 35 CFH (17 liters/minute) minimum

AMPERAGE: 190–220 A

VOLTAGE: 24–26 V

POLARITY: direct current electrode positive (dcep)

PREHEAT: None permitted

NOMINAL FILLET WELD SIZE: 1/4 in (6 mm)

WELDING PROCEDURE 6

PROCESS: Submerged Arc (SAW)

FILLER MATERIAL: AWS A5.17/A5.17M, EM12K with a neutral flux (flux manufacturer's name and trade name shall be included in test report).

DIAMETER: 1/8 in (3.2 mm)

SHIELDING GAS: Not applicable

AMPERAGE: 375–425 A

VOLTAGE: 25–27 V

POLARITY: direct current electrode positive (dcep)

PREHEAT: None permitted

NOMINAL FILLET WELD SIZE: 5/16 in (8 mm)

Annex B (Informative)

Guidelines for the Preparation of Technical Inquiries

This annex is not part of AWS D3.9:2010, *Specification for Classification of Weld-Through Paint Primers*, but is included for informational purposes only.

B1. 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.

B2. 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.

B2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry along with the edition of the standard that contains the provision(s) the inquirer is addressing.

B2.2 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.

B2.3 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.

B2.4 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.

B3. 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.

B4. Publication of Interpretations

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

B5. Telephone Inquiries

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

B6. 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.

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Annex C (Informative)

List of AWS Safety and Health Fact Sheets

This annex is not part of AWS D3.9:2010, *Specification for Classification of Weld-Through Paint Primers*, but is included for informational purposes only.

1. Fumes and Gases, October 2005
2. Radiation, October 2003
3. Noise, October 2003
4. Chromium and Nickel in Welding Fume, October 2003
5. Electrical Hazards, August 2006
6. Fire and Explosion Prevention, August 2006
7. Burn Protection, September 1995
8. Mechanical Hazards, September 1995
9. Tripping and Falling, September 1995
10. Falling Objects, September 1995
11. Confined Spaces, September 1995
12. Contact Lens Wear, September 1995
13. Ergonomics in the Welding Environment, September 1995
14. Graphic Symbols for Precautionary Labels, September 1995
15. Style Guidelines for Safety and Health Documents, September 1995
16. Pacemakers and Welding, March 1997
17. Electric and Magnetic Fields (EMF), January 1996
18. Lockout/Tagout, March 1997
19. Laser Welding and Cutting Safety, March 1998
20. Thermal Spraying Safety, February 1997
21. Resistance Spot Welding, February 1999
22. Cadmium Exposure from Welding and Allied Processes, January 2002
23. California Proposition 65, July 2001
24. Fluxes for Arc Welding and Brazing: Safe Handling and Use, January 2002
25. Metal Fume Fever, January 2002
26. Arc Viewing Distance, July 2004

27. Thoriated Tungsten Electrodes, October 2003
28. Oxyfuel Safety: Check Valves and Flashback Arrestors, April 2005
29. Grounding of Portable and Vehicle Mounted Welding Generators July 2004
30. Cylinders: Safe Storage, Handling, and Use, March 2005
31. Eye and Face Protection for Welding and Cutting Operations, December 2006

List of AWS Documents on Welding in Marine Construction

Designation	Title
D3.5	<i>Guide for Steel Hull Welding</i>
D3.6M	<i>Specification for Underwater Welding</i>
D3.7	<i>Guide for Aluminum Hull Welding</i>

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