AWS C2.20/C2.20M:2016
An American National Standard

Specification for Thermal Spraying Zinc Anodes on Steel Reinforced Concrete

American Welding Society®

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Approved by the
American National Standards Institute
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Specification for Thermal Spraying Zinc Anodes on Steel Reinforced Concrete

2nd Edition

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Prepared by the
American Welding Society (AWS) C2 Committee on Thermal Spraying

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This AWS standard is a specification for thermal spraying zinc anodes on steel reinforced concrete. This standard is formatted as an industrial process instruction. The scope includes: job description, safety, pass/fail job reference standards, feedstock materials, equipment, a step-by-step process instruction for surface preparation, thermal spraying, and quality control. There are five annexes, including job control record and portable adhesion testing.

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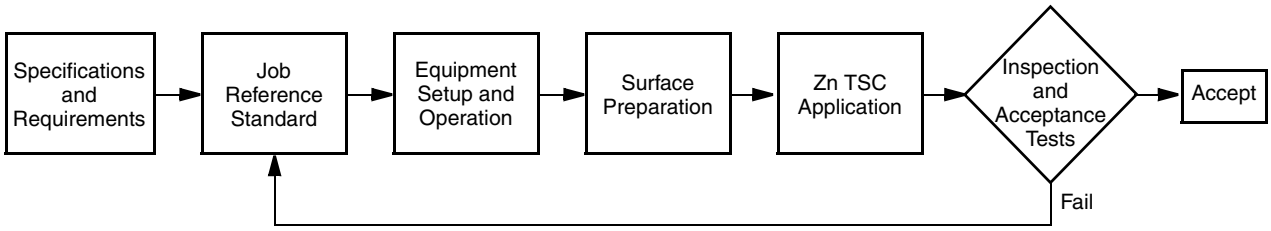
Foreword

This foreword is not part of this standard but is included for informational purposes only.

Cathodic protection (CP) is a proven technique for corrosion protection of chloride contaminated concrete structures. Zinc thermal sprayed coatings are used as distributed anodes in both sacrificial cathodic protection (SCP) and impressed current cathodic protection (ICCP) systems. The California Department of Transportation pioneered zinc thermal sprayed coatings as anodes for ICCP systems on reinforced concrete structures on the Richmond-San Rafael Bridge in 1983,[1,2] and the Florida Department of Transportation (FDOT) pioneered its use as a SCP system in 1989.[3,4] In 2012 it was estimated that the FDOT alone has used thermal sprayed zinc in over 30 bridges with a combined total of 700,000 square feet of metallized concrete. The Oregon Department of Transportation was the first to install the zinc thermal sprayed coatings as ICCP system anodes in the repairs of steel reinforced concrete on a bridge substructure in 1991. The use of thermal sprayed zinc anodes is recognized at this time as a standard practice for corrosion control on reinforced concrete members.

This AWS process standard covers the application of zinc thermal spray coatings to concrete, with a connection to the reinforcement, using arc and flame spray equipment. This standard is formatted as an industrial process instruction (see flow chart) and the scope includes: job description, safety, pass/fail job reference standards, feedstock materials, equipment, and a step-by-step process instruction for surface preparation, thermal spraying, and quality control.



There are five annexes, including safety information for thermal spraying and job control record. Further information on guidelines for CP of reinforced concrete is available in NACE Standard RP0290.

A vertical line in the margin or underlined text in clauses, tables, or figures indicates an editorial or technical change from the 2002 edition.

Comments and suggestions for the improvement of this standard are welcomed. They should be sent to the Secretary, AWS C2 Committee on Thermal Spraying, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

[1] Carello, R. A., D. M. Parks, and J. A. Apostolos, 1989, Development, Testing and Field Application of Metallized Cathodic Protection Coatings on Reinforced Concrete Substructures, *FHWA/CA/TL-89/04*, Sacramento, CA: State of California Department of Transportation.

[2] Apostolos, J. A., D. M. Parks, and R. A. Carello, Cathodic protection of reinforced concrete using metallized zinc, *Materials Performance*, V. 26, No. 12, pp. 22–28, December 1987. Available from NACE International, 1440 S. Creek Drive, Houston, TX 77084-4906.

[3] Sagues, A. A. and R. G. Powers, 1994, Sprayed Zinc Galvanic Anode for Corrosion Protection of Marine Substructure Reinforced Concrete, *SHRP-S-405*, Washington, DC: Strategic Highway Research Program.

[4] Apostolos, J. A., D. M. Parks, and R. A. Carello, Cathodic protection of reinforced concrete using metallized zinc, *Materials Performance*, V. 26, No. 12, pp. 22–28, December 1987. Available from NACE International, 1440 S. Creek Drive, Houston, TX 77084-4906.

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1. General Requirements

1.1 Scope. This standard covers the application of zinc thermal spray coatings to steel reinforced concrete using arc and flame spray equipment. The application of the zinc on steel reinforced concrete requires an electrical connection to the steel reinforcement. Although other metals can also be applied with these methods and equipment, at this time the standard only covers zinc and zinc alloys. This standard is formatted as an industrial process instruction: job description, safety, Pass/Fail Job Reference Standard, feedstock materials, equipment, a step-by-step process instruction for surface preparation, thermal spraying, quality control (QC), and a Job Control Record.

This standard is based on the literature, equipment, process developments, and industrial practices known at the time of publication. This standard does not cover the design standards or recommended practices for cathodic protection (CP) systems. The design of a CP system for reinforced concrete structures, including the connection of the zinc coating to the steel reinforcement, should be undertaken by an experienced and qualified Corrosion Engineer. Table 1 summarizes inspection, test methods, and acceptance criteria that shall be employed.

1.2 Units of Measure. This standard makes use of both U.S. Customary Units and the International System of Units (SI). The latter are shown within brackets ([ ]) or in appropriate columns in tables and figures. The measurements may not be exact equivalents; therefore, each system must be used independently. For the purposes of determining conformance with this specification, an observed or calculated value shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting values in accordance with the rounding-off method given in ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*.

1.3 Safety. Safety and health issues and concerns are beyond the scope of this standard; some safety and health information is provided in Annex B, but such issues are not fully addressed herein.

Safety and health information is available from the following sources:

American Welding Society:

(1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

(2) AWS Safety and Health Fact Sheets

(3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

(1) Safety Data Sheets supplied by materials manufacturers

(2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies

(1) NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.*

(2) U.S. Department of Labor Regulations, CFR-29, Part 1910.107, *Spray finishing using flammable and combustible materials*.

Work performed in accordance with this standard may involve the use of materials that have been deemed hazardous, and may involve operations or equipment that may cause injury or death. This standard does not purport to address all safety and health risks that may be encountered. The user of this standard should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.