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**NACE Standard NACE NO.12/AWS C2.23M/SSPC CS-23 STANDARD PRACTICE  
Item No. 21100**

# Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel

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## ABSTRACT

*Revised in 2016! This revised NACE/AWS/SSPC joint standard contains requirements for the application of zinc and aluminum alloys to steel substrates using thermal spray, often referred to as "metallizing." The metal coatings are referred to as metalized or "thermal spray coatings" (TSCs). The standard includes requirements for surface preparation, coating application, repairing coating defects, measurement of coating thickness, adhesion testing of the applied coating, and application of sealers and topcoats over the thermally sprayed metal coating. This standard is intended for use by facility owners and specifiers who develop project specifications for the application of thermally sprayed coatings for the preservation and maintenance of steel structures and components. The standard also may be used by thermal spray coating inspectors to assess the quality of surface preparation and coating application, and by thermal spray contractors to develop project work plans.*

## KEYWORDS

*bend test, coatings, corrosion resistant coatings, cut test, erosion resistant coatings, job control record, JCR, job reference standard, JRS, metallizing, protective coating, steels, TG 146, thermal spray, thermal spray equipment, TSC feedstock material, TSC inspectors, TSCs*

NACE International  
15835 Park Ten Place  
Houston, Texas 77084-5145  
+1 281-228-6200

American Welding Society (AWS)  
8669 N.W. 36th Street #130  
Miami, FL 33166  
+1 305-443-9353

SSPC: The Society for Protective Coatings (SSPC)  
800 Trumbull Drive  
Pittsburgh PA 15205  
+1 412-281-2331

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## Foreword

*In NACE/AWS/SSPC standards, the terms shall, must, should, and may are used in accordance with Paragraph 2.2.1.8 of the Agreement between NACE International and SSPC: The Society for Protective Coatings. The terms shall and must are used to state mandatory requirements. The term should is used to state something considered good and is recommended but is not mandatory. The term may is used to state something considered optional.*

This NACE/AWS/SSPC joint standard contains requirements for the application of zinc and aluminum alloys to steel substrates by melting feedstock with heat from combustion or electric arc and propelling the molten metal particles onto the substrates using compressed air or another gas. This process is called thermal spray, often referred to as "metalizing," and the metal coatings are referred to as metalized or "thermal spray coatings" (TSCs).

This standard is intended for use by facility owners and specifiers who develop project specifications for the application of thermally sprayed coatings for the preservation and maintenance of steel structures and components. It also may be used by thermal spray coating inspectors to assess the quality of surface preparation and coating application, and by thermal spray contractors to develop project work plans.

This joint standard was originally published in 2003 by SSPC<sup>(1)</sup> committee C.1.14 (formerly C.1.2.B). AWS<sup>(2)</sup> C2 Committee and NACE<sup>(3)</sup> Task Group (TG) 146. It was revised in 2016 by SSPC C.1.14, "Committee on Thermal Spray Coatings"; AWS C2 Committee on Thermal Spraying; and NACE TG 146, "Coatings, Thermal Spray," and administered by NACE Specific Technology Group (STG) 02, "Protective Coatings and Linings—Atmospheric"; and sponsored by NACE STG 39, "Process Industry—Materials Applications." It is published by NACE International under the auspices of STG 02.

<sup>(1)</sup> SSPC: The Society for Protective Coatings, 800 Trumbull Drive, Pittsburgh, PA 15205.

<sup>(2)</sup> American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166.

<sup>(3)</sup> NACE International, 15835 Park Ten Place, Houston, TX 77084-5145.

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## Section 1: General

**1.1 General:** This joint standard is a procedure for the application of metallic thermal spray coating (TSCs) of aluminum, zinc, and their alloys and composites for the corrosion protection of steel. Required equipment, application procedures, and in-process quality control (QC) checkpoints are specified. Other thermal spray corrosion and erosion resistant coatings such as carbides, cobalt, nickel, and other alloys are not included in this standard. The powder thermal spray and cold spray processes are not included in this standard.

**1.2 Scope:** Included are requirements for surface preparation, coating application, repair of coating defects, measurement of coating thickness, adhesion testing of the applied coating, and application of sealers and topcoats over the thermally sprayed metal coating. Not included in this standard are requirements for design and fabrication, thermal spray equipment qualification, coating selection, and operator and inspector certification. For successful thermal spray application, the steel structure and components should be designed and fabricated in accordance with NACE SP0178.<sup>1</sup> Additional consideration should be given to weldments and components, or structures with thermal cut edges, whose hardness may preclude adequate profile depth.

**1.3 Safety:** The basic precautions for thermal spraying are essentially the same as for welding and cutting. Information on safety can be found in ANSI<sup>(4)</sup> Z49.1, Safety in Welding, Cutting, and Allied Processes;<sup>2</sup> and NFPA<sup>(5)</sup> 58, Standard for the Storage and Handling of Liquefied Petroleum Gases.<sup>3</sup> Read and follow safety precautions in the manufacturer's equipment technical instructions and manuals and the feedstock safety data sheet (SDS). See U.S. Code of Federal Regulations (CFR)<sup>(6)</sup> Title 29 CFR 1910.94(c)(6)(i), "Ventilation,"<sup>4</sup> for Occupational Safety & Health Administration (OSHA)<sup>(7)</sup> ventilation requirements for spray booths.

**1.3.1** This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety issues associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.

**1.3.2** Potential thermal spraying hazards include exposure to vapors, dust, fumes, gases, noise (from the spray gun), and arc ultraviolet (UV) radiation. Additionally, improperly used thermal spray equipment can create potential fire and explosion hazards from oxygen, fuel, and compressed gases and a potential electrical shock hazard from the electrical and electronic equipment and charged wire spools. To minimize hazards, proper safety precautions shall be followed. Operators shall comply with the procedures in the safety references, the manufacturer's technical manuals, and the safety data sheets (SDS).

**1.3.3** All TSC equipment operators shall be qualified to a prequalified procedure before production application of the coating. Procedure and TSC equipment operator qualifications shall be retained by the contractor and made available to the end user upon request.

<sup>(1)</sup> SSPC: The Society for Protective Coatings, 800 Trumbull Drive, Pittsburgh, PA 15205.

<sup>(2)</sup> American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166.

<sup>(3)</sup> NACE International, 15835 Park Ten Place, Houston, TX 77084-5145.

<sup>(4)</sup> American National Standards Institute (ANSI), 1819 L Street NW, Suite 600, Washington, DC, 20036.

<sup>(5)</sup> National Fire Protection Association (NFPA), 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

<sup>(6)</sup> U.S. Code of Federal Regulations (CFR), U.S. Government Printing Office (GPO), 732 N. Capitol Street NW, Washington, DC 20401.

<sup>(7)</sup> Occupational Safety & Health Administration (OSHA), U.S. Dept. of Labor, 200 Constitution Ave NW, Washington, DC 20210.