

Chapter 10 Thermal Spray Applicator and Equipment Qualification

10-1. Introduction

The use of qualified thermal spray equipment and applicators helps to ensure that a quality thermal spray coating will be achieved. The qualified equipment should perform smoothly and consistently to produce dense, firmly adherent coatings without visible defects. The qualified applicator should be knowledgeable in the setup and operation of the equipment and should be able to apply a sample coating that meets the requirements of the contract.

10-2. Equipment Qualification Procedure

Each type and source of thermal spray equipment should be qualified prior to use. The equipment should conform to the following requirements related to uniformity of operation, coating appearance, and coating adhesion. Equipment should be qualified using the type and size of wire to be used on the job. The operating parameters should be those selected by the contractor for use on the job. Equipment manufacturers may also qualify their equipment for use with specific feedstocks and operating parameters. Such qualified equipment should be accepted as prequalified, assuming the contractor proposes to operate the equipment in the same manner used for the qualification tests.

a. Uniformity of operation.

(1) Wire and powder flame spray equipment.

(a) Oxygen and fuel gas flow rates. Under conditions of continuous use, the actual oxygen and fuel gas flow rates and pressures should remain nearly constant and should not deviate from the set values by more than 5 percent during a 15-min period.

(b) Atomization air pressure. Compressed air should be free of oil and water. Under conditions of continuous use, the actual atomization air pressure and flow volume should remain nearly constant and should not deviate from the set value by more than 5 percent during a 15-min period.

(c) Wire feed rate. Under conditions of continuous use, the actual wire feed rate should remain nearly constant and should not deviate from the set value by more than 5 percent during a 15-min period.

(d) Powder feed rate. Under conditions of continuous use, the actual powder feed rate should remain nearly constant and ordinarily should not deviate from the set value by more than 10 percent during a 15-min period.

(e) Continuous operation. When operated continuously for 15-min, the equipment should not sputter, pop, or stop operating.

(2) Arc spray equipment.

(a) Power. Under conditions of continuous use, the actual current output should remain nearly constant and should not deviate from the set value by more than 5 percent during a 15-min period.

(b) Voltage. Under conditions of continuous use, the actual voltage should remain nearly constant and should not deviate from the set value by more than 5 percent during a 15-min period.

(c) Wire feed rate. The wire feed mechanism should be designed for automatic alignment. Under conditions of continuous use, the actual wire feed rate should remain nearly constant and should not deviate from the set value by more than 5 percent during a 15-min period.

(d) Atomization air pressure. Under conditions of continuous use, the actual atomization air pressure and flow volume should remain nearly constant and should not deviate from the set value by more than 5 percent during a 15-min period.

(e) Continuous operation. When operated continuously for 15-min, the equipment should not sputter, pop, or stop operating.

(f) On/off operation. The equipment should be capable of continuous start and stop operation for a minimum of 15 cycles consisting of 10 sec on and 5 sec off without fusing, sputtering, or deposition of nodules.

b. Coating appearance. The applied coating should be uniform and free of blisters, cracks, loosely adherent particles, nodules, and powdery deposits.

c. Coating adhesion. A 30- × 30- × 1.25-cm (12- × 12- × 0.5-in.) flat steel plate should be cleaned and prepared in accordance with SSPC-SP 1 and SSPC-SP 5. No. 36 aluminum oxide grit should be used to produce an angular blast profile of $75 \pm 5 \mu\text{m}$ ($0.003 \pm 0.0002 \text{ in.}$). The blast profile should be measured and recorded using replica tape in accordance with ASTM D 4417. The coating ($400 \pm 50 \mu\text{m}$ ($0.016 \pm 0.002 \text{ in.}$) of 85-15 zinc-aluminum alloy, or $400 \pm 50 \mu\text{m}$ ($0.016 \pm 0.002 \text{ in.}$) of zinc, or $250 \pm 50 \mu\text{m}$ ($0.010 \pm 0.002 \text{ in.}$) of aluminum) should be applied in not less than two half-lapped passes applied at right angles to each other. The adhesion should be tested in accordance with ASTM D 4541 using a self-aligning type IV adhesion tester as described in Annex A4 of the method. Scarified aluminum pull stubs should be attached to the thermal spray coating using a two-component epoxy adhesive. The adhesive strength of the coating should be measured and recorded at five randomly selected locations. The average adhesion should not be less than 6800 kPa (1000 psi), 10,880 kPa (1600 psi), and 5100 kPa (750 psi) for 85-15 zinc-aluminum alloy, aluminum, and zinc coatings, respectively. If the test fails, it should be repeated using a new test plate. If the adhesion fails on the second plate, the equipment should be deemed unacceptable.

10-3. Applicator Qualification Procedure

a. Equipment setup and operation. The qualified applicator should be able to demonstrate a working knowledge of the application equipment to be used on the job by proper setup and operation of the equipment. The applicator should prepare a 30- × 30- × 1.25-cm (12- × 12- × 0.5-in.) flat steel plate cleaned in accordance with SSPC-SP 1 and SSPC-SP 5. Aluminum oxide or steel grit should be used to produce an angular blast profile of $3.0 \pm 0.2 \text{ mils}$. The blast profile should be measured and recorded using replica tape in accordance with ASTM D 4417. The applicator should apply the coating ($400 \pm 50 \mu\text{m}$ ($0.016 \pm 0.002 \text{ in.}$) of 85-15 zinc-aluminum alloy, or $400 \pm 50 \mu\text{m}$ ($0.016 \pm 0.002 \text{ in.}$) of zinc, or $250 \pm 50 \mu\text{m}$ ($0.010 \pm 0.002 \text{ in.}$) of aluminum) using the proper spray technique.

b. Coating appearance. The qualified applicator will have applied a coating that is uniform and free of blisters, cracks, loosely adherent particles, nodules, or powdery deposits.

c. Coating adhesion. The qualified applicator should be able to apply a firmly adherent coating that meets the adhesion requirements of the contract. The thermal spray coating adhesion should be tested in accordance with ASTM D 4541 using a self-aligning type IV adhesion tester as described in Annex A4 of the method. Scarified aluminum pull stubs should be attached to the thermal spray coating using a two-component epoxy adhesive. The adhesive strength of the coating should be measured and recorded at five randomly selected locations. The average adhesion should not be less than 6800 kPa (1000 psi), 10,880 kPa (1600 psi), and 5100 kPa (750 psi) for 85-15 zinc-aluminum alloy, aluminum, and zinc coatings, respectively.