



**NACE Standard TM0190-2006
Item No. 21221**

Standard Test Method

Impressed Current Laboratory Testing of Aluminum Alloy Anodes

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Foreword

This standard test method describes a quality assurance procedure for determining the potential and current capacity characteristics under laboratory conditions for aluminum alloy anodes used for cathodic protection (CP). Field performance of anodes should be evaluated to correspond to actual anode performance.

This standard is intended primarily for users, designers, and manufacturers involved with the application of CP in marine environments. This standard can be used by manufacturers and users of aluminum anodes for quality control verification. The most common usage is expected to be by manufacturers to meet quality control requirements requested by the purchasing user.

This standard was originally prepared in 1990 by NACE International Task Group T-7L-2 on Aluminum Anode Quality Control, a component of Unit Committee T-7L on Cathodic Protection, in conjunction with ASTM⁽¹⁾ Task Group G01-09-02 T-1. This standard was revised by Task Group T-7L-12 in 1998, and was reaffirmed by Specific Technology Group (STG) 30 on Oil and Gas Production: Cathodic Protection in 2006. It is issued by NACE under the auspices of STG 30. These committees are composed of industry representatives, including producers, consumers, and interested individuals.

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⁽¹⁾ ASTM International, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.

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Contents

1. General.....	1
2. Summary of Test Method.....	2
3. Test Apparatus.....	2
4. Reagents.....	5
5. Preparation of Test Specimens.....	6
6. Preparation of Apparatus for Test.....	6
7. Procedure.....	7
8. Calculation of Efficiency.....	8
References.....	8
Bibliography.....	9
Figure 1: Hydrogen Evolution Test Set-Up.....	3
Figure 2: Sacrificial Copper Plate and Copper Coulometer.....	4
Figure 3: Wiring Diagram.....	5
Table 1—Nominal Alloy Composition Ranges for Anodes Tested (%).....	1
Table 2—Range of Evaluation Results.....	1

Section 1: General

1.1 This standard test method describes a laboratory procedure for determining the potential and current capacity characteristics of aluminum alloy anodes used for CP. It provides a means for screening various heats or lots of anodes to determine performance consistency on a regular basis from lot to lot. Items such as sampling frequency and performance criteria (i.e., test values and intermediate times) are left to the discretion of the user of the test method.

1.2 One test method for anode potential evaluation and two test methods for anode current capacity evaluations are described.

1.3 The actual values obtained in these tests should not be used for design purposes because they represent laboratory testing.

1.4 This procedure can be validated by using zinc anode samples as a reference in the test to verify results of aluminum anodes tested. Zinc samples shall be as defined in ASTM B 418 Type I (Vol 02-Q4)¹ or Military Specification MIL-A-18001² for zinc anodes.

1.5 This procedure was evaluated by testing alloys of Al-Zn-Sn, Al-Zn-Hg, Al-Zn-In-Mg, and MIL-A-18001 zinc of the respective nominal alloy composition ranges shown in Table 1. The results of the test are reported in paper #346 presented at CORROSION/84.³

1.6 The precision of the test has not been validated. The scatter in the test results is considered to result from heterogeneities in aluminum alloy anode materials in general, as tested, rather than the test method itself. Only anode materials exhibiting good, reproducible performance (in accordance with this test method) meeting manufacturer or user specifications are acceptable.

Table 1—Nominal Alloy Composition Ranges for Anodes Tested (%)

	Al-Zn-Sn	Al-Zn-Hg	Al-Zn-In-Mg	Zinc (MIL-A-18001)
Zn	6.0 to 8.0	1.25 to 2.00	1.0 to 3.0	Remainder
Sn	0.10 to 0.20			
Si	—	—	—	0.125 max.
Hg	—	0.030 to 0.08	—	—
Pb	—	—	—	0.006 max.
Mg	—	—	0.50 to 1.0	—
In	—	—	0.20	—
Fe	0.10 max.	0.10 max.	0.10 max.	0.005 max.
Cd	—	—	—	0.025 to 0.15
Cu	0.003 max.	0.003 max.	0.010 max.	0.005 max.
Al	Remainder	Remainder	Remainder	0.10 to 0.50

1.6.1 Ranges of performance from those alloys tested are listed in Table 2.

Table 2—Range of Evaluation Results

Alloy	Operating Potential (SCE ^(A) -mV)	Hydrogen Evolution (% Efficiency)	Impressed Current Capacity	
			A-h/kg	A-h/lb
Al-Zn-Sn	940 to 1,176	70 to 94	1,014 to 2,711	460 to 1,230
Al-Zn-Hg	830 to 1,114	96	2,623 to 2,949	1,190 to 1,338
Al-Zn-In-Mg	1,032 to 1,140	90	2,354 to 2,742	1,068 to 1,244
Zinc	969 to 1,051	98	754 to 804	342 to 365

^(A) Saturated calomel electrode.

1.6.2 Performance of other alloys tested with this procedure has not been determined.