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**CORROSION CONTROL MATERIALS**

Anodes, Magnesium

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**1. SCOPE**

This specification covers magnesium anodes for cathodic protection of buried metallic structures. The magnesium anodes may be packaged in backfill, bare or bare-driveable type.

**2. APPLICABLE DOCUMENTS**

- 2.1 ASTM International (ASTM) AZ 31B, "Magnesium Alloy."
- 2.2 ASTM International (ASTM) B843-07, "Standard Specification for Magnesium Alloy Anodes for Cathodic Protection."
- 2.3 ASTM International (ASTM) G-97, "Standard Test Method for Laboratory Evaluation of Magnesium Sacrificial Anode Test Specimens for Underground Applications."
- 2.4 United States Department of Transportation (DOT), Code of Federal Regulations, Title 49, Part 192, "Transportation of Natural and Other Gas by Pipelines Minimum Safety Standards."

**NOTE:** Unless otherwise specified, the editions of the above documents incorporated by DOT 49 CFR 192 are applicable. Documents not incorporated by DOT 49 CFR 192 will be the most recent edition.

**3. TERMINOLOGY**

**3.1 General**

- 3.1.1 "Southwest Gas," "Southwest" or "SWG" wherever used in this specification and other related documents will refer exclusively to Southwest Gas Corporation.
  - 3.1.2 The terms "approved," "as approved," "satisfactory," "as directed," "or equal" or other similar terms wherever used in this specification and other related documents will mean "as determined by Southwest Gas," unless specifically stated otherwise.
  - 3.1.3 "Product Information Package" or "PIP" wherever used in this specification and other related documents will mean the required technical product information that a manufacturer must submit to Southwest to determine if the product is suitable for use by Southwest, unless specifically stated otherwise.
- 3.2 "Anode Weight" is the minimum physical poundage of the active anode material only. The total anode assembly may actually weigh more.



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**4. MATERIALS AND MANUFACTURING**

- 4.1 The allowable anode weights are as follows: 1, 2.5, 5, 9, 17, 20, 32 or 50 pounds. Driveable anodes may be 1 or 2.5 pounds anode weight only.
- 4.2 The active anode material shall be free of foreign metal inclusions. The alloy composition shall conform to Table L-7.1 by percent of weight.

MATERIAL	ANODE TYPE					
	High Potential		Grade A		Extrusion	
	Min. %	Max. %	Min. %	Max. %	Min. %	Max. %
Aluminum		0.010	5.3	6.7	2.5	3.5
Manganese	0.50	1.3	0.15		0.20	1.0
Zinc		0.0	2.5	3.5	0.7	1.3
Silicon		0.05		0.10		0.1
Copper		0.02		0.02		0.05
Iron		0.03		0.003		0.005
Nickel		0.001		0.002		0.005
Other Elements, Each		0.05				
Other Elements, Total		0.30		0.30		0.30
Magnesium	Balance		Balance		Balance	

**TABLE L-7.1**

- 4.3 All anodes, except the 50-lb. and driveable type, shall be packaged with backfill unless specifically noted on purchase order. When backfill is required, the anode shall be centered in a water-permeable cloth sack. The sack opening shall be securely fastened closed. The backfill shall be dry, finely powdered and uniformly mixed.
- 4.4 The backfill material composition by volume shall be:
  - Hydrated Gypsum, 75% +/- 3%
  - Bentonite Clay, 20% +/- 2%, and
  - Sodium Sulfate, 5% +/- 1%
- 4.5 The weight of the backfill material shall conform to Table L-7.2.



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**4. MATERIALS AND MANUFACTURING (Cont'd)**

<b>ANODE WEIGHT (Lbs.)</b>	<b>BACKFILL WEIGHT (Lbs.)</b>
1 (Driveable)	None
2.5 (Driveable)	None
5	9
9	14
17	25
20	50
32	36
50	None

**TABLE L-7.2**

- 4.6 Each anode shall contain a core of steel wire or strap extending at least three-quarters into the anode's length. The core shall be galvanized or otherwise metallurgically bonded to the cast magnesium alloy.
- 4.7 The core at any cross section shall not lie closer to the outer surface of the anode than 25% of the width of the cross section of the anode. The core shall terminate in a recess in the top of the non-driveable anodes.
- 4.8 A 5-foot long #12 or #14 AWG solid copper wire with type TW or THWN insulation shall be attached to the driveable anodes.
- 4.9 A 10-foot long #12 or #14 AWG solid copper wire with type TW or THWN insulation shall be attached to all non-driveable anodes. The free end of the wire shall have the insulation removed for a length of 3/4-inch. The wire shall extend through the top of the bag of the backfill-packaged anodes.
- 4.10 The copper wire shall be crimped and silver soldered to the core of the driveable anodes. The connection is to be covered with a waterproof sealant. A .750-inch to 1.250-inch stainless steel installation clamp will be affixed to the other end of the wire using a ring type connector. The ring connector shall be affixed to the wire by crimping and rosin core soldering. The clamp shall have a nut and hardened tip screw for penetration through coatings.
- 4.11 The copper wire shall be wrapped around and soldered to the core of the non-driveable anodes. The recess shall be filled even with the anode top with a potting compound.



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**4. MATERIALS AND MANUFACTURING (Cont'd)**

4.12 Drivable anodes are to be topped with a machined nylon cap, to prevent damage to the wire-to-anode connection during installation. The cap must be able to resist breakage from the blow of a sledgehammer, used for installation. The cap to anode interface will be designed in a manner to prevent damage to the wire or wire-to-anode connection.

**5. PERFORMANCE REQUIREMENTS**

The anodes should meet the requirements shown in Table L-7.3 at a minimum.

PROPERTY	ANODE TYPE		
	High Potential	Grade A	Extrusion
*Amp/Hrs./Lb.	≥ 500	≥ 500	≥ 500
*Efficiency	≥ 50%	≥ 50%	≥ 50%
*Open Circuit Potential	-1.70V ~ -1.75V	-1.50V ~ -1.55V	-1.50V ~ -1.55V
*Per ASTM G-97			

**TABLE L-7.3**

**6. DIMENSIONS AND TOLERANCES**

The typical dimensions of the anodes are shown in Appendix A, Table L-7.4.

**7. INSPECTION**

7.1 Successful review of the Product Information Package (PIP), as well as any future reference by SWG to the Seller's part number or internal code number in any future contract or purchase, will mean only that no conflict with the specification was found, and will not relieve the seller from meeting all the requirements of this specification.

7.2 SWG retains the option to inspect the manufacture and testing of all materials sold to SWG.

7.3 SWG will make appropriate inspections and tests of any and all materials, products or systems supplied to this specification. SWG will have the right, at their option, to reject any material, which fails to conform to this specification. Any such rejection may take place at the manufacture's facility; the supplier's warehouse or any subsequent delivery location, before or after SWG assumes possession. Notice of the rejection will be made promptly to the supplier by SWG. The defective product will be replaced or returned for credit at the manufacturer's expense.



## **SOUTHWEST GAS CORPORATION**

**ENGINEERING STAFF**

### ***MATERIAL SPECIFICATION***

*Prepared By:* Engineering Staff 

*Approved By:* Jerome T. Schmitz 

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#### **7. INSPECTION (Cont'd)**

7.4 Any changes in the manufacturing of previously approved materials, products or systems described in this material specification for sale to SWG must be approved by SWG's Engineering Staff. **Failure to obtain SWG's approval may be cause for rejection and disqualification as an approved supplier.**

#### **8. CERTIFICATION**

The manufacturer's or supplier's certification will be furnished to SWG. This certification will state that samples representing each lot have been manufactured, tested and inspected in accordance with this specification and that all requirements have been met. When specified in the purchase order or contract, a report of results will be provided.

Upon the request of Southwest, the certification of an independent third party indicating conformance to the specification may be considered at Southwest's expense.

#### **9. SAFETY DATA SHEETS**

In accordance with law, the seller will supply Safety Data Sheets for all applicable items supplied under this specification to the following:

- 1) The Receiving Location
- 2) Engineering Staff
- 3) Southwest Gas Corporation  
Corporate Safety  
Mail Station LVA-120  
P.O. Box 98510  
Las Vegas, NV 89193-8510



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**10. PACKAGING AND PACKAGE MARKING**

- 10.1 Non-driveable anodes shall be shipped in a sealed, reinforced water-resistant bag or container, to provide protection against damage to the backfill sack. The maximum bag or container weight as shipped shall be 90 lbs. If stored on a pallet, the shipping bags must be protected as to prevent damage if moved by forklift.
- 10.2 Drivable anodes shall be shipped in a box or container. No more than a quantity of fifty (50) 1# anodes or twenty (20) 2.5# anodes shall be packaged in the same container.
- 10.3 The shipping bag or container shall be marked with the manufacturer's name and/or trademark, type of anode (magnesium), weight of anode (i.e., 32 lbs.) and number of units.
- 10.4 All products covered in this specification will be packaged in a manner to prevent damage during transportation and storage.



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**11. STOCK CLASS DESCRIPTION**

ANODE, \_\_\_-LB, MAGNESIUM, H-1 ALLOYED GRADE A, WITH 10 FEET OF NO. 12 OR 14 TYPE TW OR THWN SOLID COPPER LEAD WIRE, WITH BACKFILL MIXTURE, PACKAGED INDIVIDUALLY.

ANODE, \_\_\_-LB, MAGNESIUM, HIGH POTENTIAL, WITH 10 FEET OF NO. 12 OR 14 TYPE TW OR THWN SOLID COPPER LEAD WIRE, WITH BACKFILL MIXTURE, PACKAGED INDIVIDUALLY.

ANODE, \_\_\_-LB, MAGNESIUM, DRIVEABLE, WITH MACHINED NYLON CAP, APPROXIMATE DIMENSION 1.300-INCH x \_\_\_-INCH, H-1 ALLOY GRADE A, WITH STAINLESS STEEL INSTALLATION CLAMP FROM .750-INCH TO 1.250-INCH, SCREW AND NUT ON CLAMP, 5 FEET OF NO. 12 OR 14 TYPE TW OR THWN SOLID COPPER LEAD WIRE.



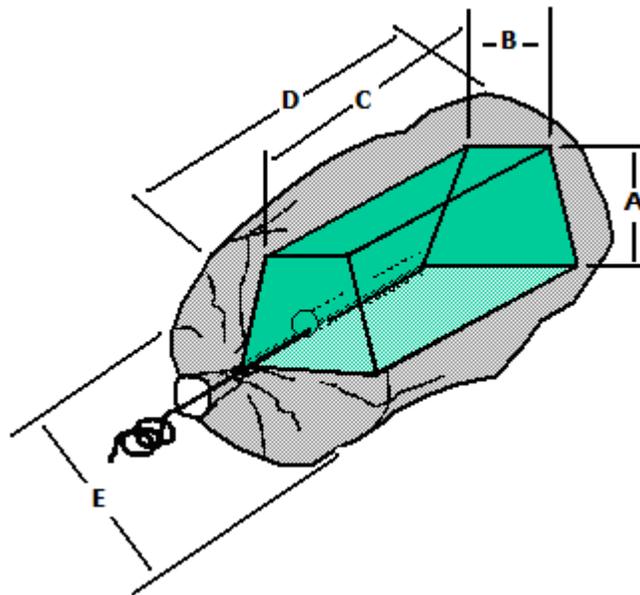
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**APPENDIX A**

**TYPICAL DRAWING – ANODE**

(Non-Drivable Prepackaged Anode Shown)



ANODE NOMINAL WT. (Lbs. Bare)	TYPICAL DIMENSION (Inches)				
	A	B	C	D	E
1	1.3 $\Phi$	Round	12	N/A	N/A
2.5	1.3 $\Phi$	Round	30	N/A	N/A
5	3	3	3	11	6
9	3	3	13.5	15.5	6
17	4	4	17	21	6.5
20	2	2	60	64	5
32	5	5	20	26	8
50	8 $\Phi$	Round	16	N/A	N/A

$\Phi$  = Diameter

**TABLE L-7.4**