SOUTHWEST GAS CORPORATION

ENGINEERING STAFF

MATERIAL SPECIFICATION

Section No:	MS L-4
Page No.:	1 of 7
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CORROSION CONTROL MATERIALS

Graphite Anode

1. SCOPE

This specification covers cylindrical graphite anodes used in impressed current cathodic protection systems.

2. APPLICABLE DOCUMENTS

2.1 Southwest Gas Material Specification (MS L-10), "Underground Wire and Cable."

2.2 United States Department of Transportation (DOT), Code of Federal Regulations (CFR), title 49, Part 192, "Transportation of Natural and Other Gas by Pipeline' 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 information that a manufacturer must submit to SWG to determine if the product is suitable for use by SWG, unless specifically stated otherwise.

4. MATERIALS AND MANUFACTURING

4.1 The graphite will be UCAR YCA-79 or equivalent. This graphite is resin impregnated to reduce porosity and the effects of lamination.

4.2 The cable will be #8 AWG size single conductors, stranded copper wire with splice free high molecular weight polyethylene insulation in accordance with Southwest Gas MS L-10. Lead wire length will be specified on the purchase order.

4. MATERIALS AND MANUFACTURING (Cont'd)

4.3 The cable to anode connection will be a center connection type as shown in Appendix A of this specification.

4.4 The lead wire hole will be sealed with an approved electrical sealing compound. The compound will be chemically inert, non-expansive and waterproof.

4.5 The anode cap compound will be an approved two component material consisting of a hardener and a resin. The compound will be chemically resistant, waterproof, of low toxicity and form a tight moisture seal to the anode material and lead wire.

4.6 The lead wire to center connection joint will be soldered. Soldered joints will exhibit good flow and saturation.

5. PERFORMANCE REQUIREMENTS

5.1 Physical Properties

The graphite anode will have the following physical properties. All units are English; metric units are shown in parentheses.

	MINIMUM	MAXIMUM
Bulk Density, Lb/ft3 (g/cc)	100 (1.602)	120 (1.922)
Resistivity	_____	0.254(10)
Flexural Strength, psi (MPa)	4000 (28)	_____
Porosity %	_____	2.0

TABLE MS L-4.1

5.2 The pull-out strength of the lead wire from the anode will exceed the tensile yield strength of the 8 AWG lead wire.

6. DIMENSIONS AND TOLERANCES

6.1 Graphite anodes manufactured to this specification will be cylindrical with the following dimensions:

Diameter	Length
3”	60”
4”	80”

TABLE MS L-4.2

6.2 The center connection depth and length are indicated in Fig. A-1 of Appendix A.

6.3 The lead wire length will be between 8 to 1000 feet as specified on the purchase order.

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 any and all materials, products or systems referenced in this specification that are 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 manufacturer 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 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.

7.4 Any changes in the manufacturing of previously approved Graphite Anode covered under this 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.**

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Graphite Anode

8. CERTIFICATION

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

6. 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

7. PRODUCT MARKING

All Graphite Anode sold to Southwest will be marked with the following:

- Manufacturer's name or trademark
- Manufacturer's part number
- Material identification
- Nominal pipe size
- Schedule or nominal wall thickness

Southwest retains the right to require the Graphite Anode to be marked with Southwest's purchase order number and/or head code identity.

8. PACKAGING AND PACKAGE MARKING

Graphite anodes will be packaged for shipment on pallets or crated as specified by Southwest Gas. Packaging will prevent any damage that may occur to the anode or lead wire during transit or storage.

9. STOCK CLASS DESCRIPTION

ANODE, GRAPHITE, _____ INCHES DIAMETER X _____ INCHES LONG; RESIN IMPREGNATED, CENTER CONNECTED, _____ LBS. WITH _____ FEET OF #_____ AWG HMWPE LEAD WIRE, STRANDED.