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CORROSION CONTROL MATERIALS

Underground Wire, Cable and Conductors

1. SCOPE

This specification covers wire and cable used in direct burial, direct current applications (including cathodic protection applications) and wire to be used as tracer wire in locating buried plastic piping.

2. APPLICABLE DOCUMENTS

2.1 American National Standards Institute (ANSI) and American Society for Quality Control (ASQC) Z-1.4, “Sampling Procedures and Tables for Inspection by Attributes.”

2.2 American National Standards Institute (ANSI) and Underwriters Laboratory (UL) 83, “Thermoplastic-Insulated Wires and Cables.”

2.3 American National Standards Institute (ANSI) and Underwriters laboratory (UL) 1581, “Reference Standard for Electrical Wires, Cables and Flexible Cords.”

2.4 ASTM International (ASTM) B-3, “Soft or Annealed Copper Wire.”

2.5 ASTM International (ASTM) B-8, “Concentric-lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.”

2.6 ASTM International (ASTM) D-1248, “Polyethylene Plastics Molding and Extrusion Material.”

2.7 NEC (National Electrical Code) Current Edition.

2.8 National Electrical Manufacturers Association (NEMA) WC-70, “Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.”

2.9 United States Department of Transportation (DOT), Code of Federal Regulations (CFR), title 49, Part 192, “Transporation 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, CFR192 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 Insulated Wire Type TW

The TW-type insulated wire will be an insulated solid or stranded wire suitable for operation in wet or dry locations at a maximum conductor temperature of 60°C for circuits not exceeding 600 volts and will meet the following requirements:

- The TW-type insulated wire will meet the requirements of the National Electrical Code®.
- The physical, aging, deformation, water deformation, water absorption, insulation resistance and flexibility requirements will meet the requirements of UL 83.
- The TW-type insulation (PVC) will have an average insulation thickness as shown in Table L-10.1.
- The solid wire will be soft or annealed copper meeting the requirements of ASTM B-3. The nominal diameters of the wire will be as tabulated in Table L-10.1. Stranded sizes are per Table L-10.2.
- Wire to be used as tracer wire for non-boring installations will be AWG Size 14 with orange insulation.

4. MATERIALS AND MANUFACTURING (Cont'd)

4.1 Insulted Wire Type TW (Cont'd)

- Wire to be used as tracer wire for boring installations will be AWG Size 10 copper clad steel with yellow insulation.

4.2 Insulated Wire Type THHN-THWN

The THWN-type insulated wire will be an insulated solid or stranded wire suitable for operation in wet or dry locations at a maximum conductor temperature of 60°C for circuits not exceeding 600 volts and will meet the following requirements:

- The THHN-THWN type insulated wire will meet the requirements of the National Electrical Code®.
- The solid wire will be soft drawn or annealed copper meeting the requirements of ASTM B-3. The nominal diameters of the wire will be as tabulated in Table L-10.1. Stranded sizes are per Table L-10.2.
- Wire to be used as tracer wire for non-boring installations will be AWG Size 14 with orange insulation.
- Wire to be used as tracer wire for boring installations will be AWG Size 10 with yellow insulation.
- The physical, aging, deformation, water absorption, insulation resistance and flexibility requirements will meet the requirement of UL 83.
- The insulation color for wire other than tracer wire will be either black or white unless approved otherwise by Engineering Staff.

4. MATERIALS AND MANUFACTURING (Cont'd)

4.2 Insulated Wire Type THHN-THWN (Cont'd)

- The THHN-THWN type insulation (PVC) will have an average insulation thickness as shown in Table L-10.1.

AWG Size	Minimum Average Thickness* Inches (mils)	Nominal Diameter (Mils)
14	2/64 (30)	64.1
12	2/64 (30)	80.8
10	2/64 (30)	101.9
8	3/64 (45)	128.5
*The thickness at any point will be at least 90% of this minimum average thickness.		

TABLE L-10.1

4.2 Insulated Cable Type HMW PE

The high molecular weight polyethylene (HMW PE) insulated cable will be stranded single conductor and will meet the following requirements:

- The conductor strands shall be uncoated, soft or annealed copper in accordance with ASTM B-3.
- The conductor will be concentrically stranded according to ASTM B-8, Class B.
- The HMW PE insulation will be a weather-resistant compound meeting the requirements, before extrusion, of ASTM D-1248, Type 1, Class C, Grade 5, except the nominal flow rate will be of 0.35 maximum.

4. MATERIALS AND MANUFACTURING (Cont'd)

4.3 Insulated Cable Type HMW PE (Cont'd)

- The HMW PE will be according to Table L-10.2.

High Molecular Weight Polyethylene Construction				
Conductor or Size AWG	**Stranding**		**Insulation Thickness Inches**	**Approximate Overall Diameter Inches**
	No.	**Wire Diameter Inches**		
12(1)	7	0.0808	0.03125	0.09
10(1)	7	0.1019	0.03125	0.11
8	7	0.0486	0.110	0.37
6	7	0.0612	0.110	0.41
4	7	0.0772	0.110	0.46
2	7	0.0974	0.110	0.52
1/0	19	0.0745	0.125	0.63
2/0	19	0.0837	0.125	0.67
4/0	19	0.1055	0.125	0.78
(1) Insulation is TW or THHN-THWN				

TABLE L-10.2

5. PERFORMANCE REQUIREMENTS

5.1 The HMW PE insulation removed from or tested on the conductor cable will meet the requirements of NEMA WC-70.

5.2 The THHN-THWN insulated conductor will be capable of withstanding, without breakdown, the application of a test potential of 1000 bolts for 0 seconds after immersion in water at room temperature for 6 hours while still being immersed.

5.3 Following the dielectric strength test, the wire will be tested for THHN-THWN insulation resistance which will be lost not less than the meg-ohms per 1000 feet.

6. DIMENSIONS AND TOLERANCES

6.1 The cable size will be 8, 6, 4, 2, 1/0, 2/0 or 4/0 American Wire Gage.

6.2 The average thickness of the insulation and jacket will not be less than shown in Table L-10.1 or Table L-10.2.

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 supplied to SWG under this specification at the manufacturer's facility.

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 defective product will be replaced or returned for credit at the manufacturer's expense.

7. INSPECTION (Cont'd)

7.4 Any changes of previously approved products 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.**

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.

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:

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

10. PRODUCT MARKING

10.1 The HMWPE insulated cable will have a durable surface marking at approximately 12-inch intervals along it's entire length to include:

- Manufacturer's name or trademark
- Designation for high molecular weight polyethylene (PE) insulation
- AWG size

10.2 The TW type or THHN-THWN wire will have a durable surface marking at intervals not greater than 24-inches along the entire length to include:

- Manufacturer's name or trademark
- Wire insulation type
- Maximum working voltage-600 volts
- Size AWG or circular mil area

10.3 Wire to be used as tracer wire will be marked at intervals not greater than one foot including the following:

- Manufacturer's name or trademark
- The conductor size (AWG)

11. PACKAGING AND PACKAGE MARKING

11.1 All products covered in this specification will be packaged to prevent damage during shipping.

11.2 The cable will be delivered in one continuous 1000 foot lengths on a wood or metal reel or a High Impact Polystyrene Spool.

11. PACKAGING AND PACKAGE MARKING (Cont'd)

11.3 The TY-type or THWN-type wire to be used as a tracer wire will be packaged in 500 foot continuous lengths on a wood or metal reel. The tag or carton will include the following:

- Manufacturer's name or trademark
- Conductor size (AWG)
- Color
- Date of manufacture
- "Pipeline Tracer Wire" legibly printed

12. STOCK CLASS DESCRIPTION

WIRE, COPPER STRANDED, _____ (COLOR), SINGLE CONDUCTOR, TYPE 1, CLASS C, GRADE 5, CATHODIC PROTECTION TYPE, NO. _____ MINIMUM 100 MILS HMW PE, _____FOOT REEL.

WIRE, COPPER STRANDED, _____ (COLOR), SINGLE CONDUCTOR, TYPE 1, CLASS C, GRADE 5, CATHODIC PROTECTION TYPE, NO. _____ MINIMUM 100 MILS THWN, _____ FOOT REEL.

WIRE, COPPER STRANDED, _____ (COLOR), SINGLE CONDUCTOR, TYPE 1, CLASS C, GRADE 5, CATHODIC PROTECTION TYPE, NO. _____ MINIMUM 100 MILS TW, _____ FOOT REEL.

WIRE, CONDUCTOR, COPPER, #_____ (SIZE) THHN/THWN _____ VOLT.

WIRE, COPPER, STRANDED, BLK, SINGLE, CONDUCTOR, TYPE 1.

WIRE, COPPER, STRANDED WHITE, SINGLE, CONDUCTOR, TYPE 1.