Raychem

Wire and Cable Division

Raychem Corporation, 300 Constitution Drive, Menlo Park, CA 94025

SPECIFICATION:	**ZHPC**
THIS ISSUE:	**Issue 1**
DATE:	**20 December 1995**
REPLACES:	**None**

WIRE, ELECTRIC, HALOGEN FREE POLYOLEFIN INSULATED COPPER OR COPPER ALLOY

1. SCOPE

1.1 GENERAL

This specification covers finished wire for rail and mass transit applications where the finished wires are insulated with an extruded, halogen free, flame retardant, polyolefin material.

1.2 CLASSIFICATION

Products in accordance with this specification shall be the following type and as specified in the applicable specification sheet.

Finished Wire: A single stranded conductor, insulated as specified in the applicable specification sheet.

1.2.1 TEMPERATURE INDEX

Products in accordance with this specification have a temperature index rating of at least 7500 hours at 125°C (*TI7.5kh/125°C*) when tested in accordance with ASTM D3032 using a 12AWG 600V wire.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B 3	Specification for Soft or Annealed Copper Wire
B 33	Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes

B 193	Standard Test Method for Resistivity of Electrical Conductor Materials
B 471	Standard Test Method for Rubber Property - Effect of Liquids
B 624	Standard Specification for High-Strength, High-Conductivity Copper-Alloy Wire for Electronic Application
B 975	Specification for Diesel Fuel Oils
D 3032	Standard Test Methods for Hookup Wire Insulation
D 2671	Test Methods for Heat-Shrinkable Tubing for Electrical Use
F 814	Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials for Aerospace Applications

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

2.2 FEDERAL TEST METHOD STANDARDS

FED-STD-228 Wire and Wire, Insulated; Methods of Testing

(Copies of FED-STD-228 may be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.)

2.3 INSULATED CABLE ENGINEER'S ASSOCIATION (ICEA)

ICEA S-66-524 Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

(Copies of ICEA specifications may be obtained from the National Electrical Manufacturers Association, 2101 L Street, N.W., Washington, D.C., 20037)

2.5 MILITARY STANDARDS

MIL-C-24640 Cables, Lightweight, Electric, Low Smoke, for Shipboard Use, General Specification For

NES 713 Determination of the Toxicity Index of the Products of Combustion From Small Specimens of Materials (Ministry of Defence, Great Britain)

2.7 UNDERWRITER'S LABORATORY STANDARDS (UL)

UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
UL 44	Rubber-Insulated Wires and Cables

(Copies of UL Standards may be obtained from Underwriters Laboratories Inc., Publications Department, 1655 Scott Boulevard, Santa Clara, CA, 95050-4169)

3. REQUIREMENTS

3.1 SPECIFICATION SHEETS

The requirements for the wire furnished under this specification shall be as listed in the applicable specification sheet, or within the body of this specification. In the event of conflict, the requirements of the applicable specification sheet shall govern.

3.2 MATERIALS

Materials not specifically designated herein shall be of the quality and form best suited for the purpose intended. Unless otherwise specified, the materials shall meet the following requirements:

3.2.1 Stranded Conductor Materials

Stranded conductor material shall be bare annealed copper in accordance with ASTM B 3, tinned annealed copper in accordance with ASTM B 33, high strength copper alloy in accordance with ASTM B 624, or as specified by the applicable specification sheet.

3.2.2 Insulating Materials

The extruded insulation materials shall be halogen free polyolefin.

3.2.3 Color

The finished wire color shall be black.

3.3 FINISHED WIRE

Finished wire shall conform to the requirements of Table I, to those of the applicable specification sheet, and to the following, as applicable.

3.3.1 Abrasion Resistance

When tested in accordance with 4.4.1 herein, the average of eight readings shall be not less than 1000 cycles.

3.3.2 Cold Bend

When tested in accordance with 4.4.2 herein, there shall be no cracking and no dielectric breakdown of the finished wire insulation.

TABLE I: PROPERTIES OF FINISHED WIRE

Examination or Test	Requirement	Test Method	Test Type
Abrasion Resistance	3.3.1	4.4.1	Q
Cold Bend	3.3.2	4.4.2	Q
Concentricity	Specification Sheet	ASTM D3032, Section 16	P
Conductor Resistance	Specification Sheet	QCM 2808	V
Copper Mirror Corrosion	3.3.3	ASTM D2671, Section 97	Q
Crosslink Proof Test	3.3.4	4.4.3	P
Crush Resistance	3.3.5	UL 1581, Section 620	Q
Current Overload - Single Wire	3.3.6	4.4.4	Q
Current Overload - Bundle	3.3.7	4.4.5	Q
Dimensions	Specification Sheet	ASTM D3032, Section 15	P
Dynamic Cut Through	3.3.8	ASTM D3032, Section 22	Q
Flammability	Specification Sheet	4.4.6	Q
Halogen Content	3.3.9	MIL-C-24640	Q
Insulation-Continuity Proof Testing	Specification Sheet	ASTM D3032, Section 13, Method A	100%
Insulation Resistance	Specification Sheet	4.4.7	Q
Insulation Resistance - Elevated Temperature in Water	3.3.10	4.4.8	Q
Insulation Resistance - Elevated Temperature in Air	3.3.11	4.4.9	Q
Insulation Tensile Strength and Ultimate Elongation	Specification Sheet	4.4.10	P
Materials and Construction	3.2 and Specification Sheet	4.4.11	P
Oil Resistance I	3.3.12	4.4.12	Q
Oil Resistance II	3.3.13	4.4.13	Q
Shrinkage	Specification Sheet	4.4.14	Q
Smoke Emission	3.3.14	ASTM F814	Q
Thermal Aging - Insulation Resistance	3.3.15	4.4.15	Q
Thermal Aging - Cold Bend	3.3.16	4.4.16	Q
Toxicity Index	3.3.17	NES 713	Q
Voltage Withstand	3.3.18	4.4.17	Q
Weight	Specification Sheet	4.4.18	P
Workmanship	3.3.19	4.4.19	P

Test Type:

P = In Process or Lot Test
100% = 100% of finished product testing
Q = Qualification testing
V = Vendor Test

3.3.3 Copper Mirror Corrosion

When tested in accordance with ASTM D2671 Section 97 at a temperature of 175°C using a 1 inch length of insulation stripped from the conductor, the percent corrosion of the copper mirror shall be less than 5%.

3.3.4 Crosslink Proof Test

When tested in accordance with 4.4.3 herein, there shall be no evidence of melting or flowing.

3.3.5 Crush Resistance

When tested in accordance with Underwiters Laboratories Standard 1581, Section 620, the minimum average shall not be less than 2500 lbs.

3.3.6 Current Overload - Single Wire

When tested in accordance with 4.4.4 herein, there shall be no dielectric breakdown of the finished wire insulation.

3.3.7 Current Overload - Bundle

When tested in accordance with 4.4.5 herein, there shall be no visible smoke generated, no visible derangement of the wire bundle, no blocking of adjacent insulation layers, and no incidence of insulation splits, ruptures or charring.

3.3.8 Dynamic Cut Through

When tested in accordance with ASTM D3032, Section 22 using the optional 0.0050±0.0005 inch cutting edge at 23±2°C (73±4°F), the average dynamic cut-through shall not be less than 45 lbs.

3.3.9 Halogen Content

When tested according to MIL-C-24640, the halogen content of the wire insulation material shall not exceed 0.2%.

3.3.10 Insulation Resistance - Elevated Temperature in Water

When tested in accordance with 4.4.8 herein, the insulation resistance at 90°C in water shall not be less than 5.0 megohms for 1,000 feet.

3.3.11 Insulation Resistance - Elevated Temperature in Air

When tested in accordance with 4.4.9 herein, the insulation resistance at 150°C (302°F) in air shall not be less than 5 megohms for 1,000 feet.

3.3.12 Oil Resistance I

When tested in accordance with 4.4.12 herein, the percent retention of tensile strength and percent retention of elongation shall not be less than 50% after 6 days immersion.

3.3.13 Oil Resistance II

When tested in accordance with 4.4.13 herein, the maximum diameter increase (swell) shall not exceed 60% of the original diameter and there shall be no cracks, ruptures, splits or dielectric breakdown of the insulation.

3.3.14 Smoke Emission

When tested in accordance with ASTM F814, the specific optical density (D_s) of the smoke generated from a 5 foot ±1/2 inch sample shall not exceed 100 within 90 seconds of the start of the test, or 200 within 4 minutes of the start of the test.

3.3.15 Thermal Aging - Insulation Resistance

When tested in accordance with 4.4.15 herein, the finished wire shall pass the voltage withstand test of 4.4.17, and the insulation resistance requirement of the applicable specification sheet.

3.3.16 Thermal Aging - Cold Bend

When tested in accordance with 4.4.16 herein, the finished wire shall pass the cold bend test of 3.3.2.

3.3.17 Toxicity Index

When tested in accordance with NES 713, the toxicity index shall be no greater than 5.

3.3.18 Voltage Withstand

When tested in accordance with 4.4.17 herein, the finished wire shall withstand 4.5 kV rms for 5 minutes.

3.3.19 Workmanship

All details of workmanship shall be in accordance with high-grade wire and wire manufacturing practice. The insulation shall be free of cracks, splits, irregularities, and imbedded foreign material.

4. QUALITY ASSURANCE PROVISIONS

4.1 RESPONSIBILITY FOR INSPECTION

The supplier is responsible for the performance of all inspection tests specified herein. The supplier may utilize his own or any other inspection facility and services acceptable to the

buyer. Inspection records of the examinations and tests shall be kept complete and available to the buyer as required.

4.2 QUALIFICATION INSPECTION

Qualification inspection shall consist of all tests in Table 1.

4.2.1 Sampling for Qualification Inspection

The qualification sample shall be a 12AWG, 600 volt construction. Samples of finished wire for qualification shall be taken from production lots which have been manufactured under the most current Quality Control Plan.

4.3 QUALITY CONFORMANCE INSPECTION

Quality conformance inspection consists of a matrix of tests and inspections that assure that raw materials and manufacturing processes are consistent and result in products that conform to specification requirements. The classification and frequency of testing shall be determined in accordance with the requirements of the individual specifications to which the product is supplied.

4.3.1 Inspection Definitions

a. Vendor Control (V) - Requirements for raw materials such as conductor and insulation materials over which the vendor has control and responsibility.

b. Process Control (P) - Inspections performed on samples taken from the lots of wire. Inspections may be performed on finished wire or after the process which establishes the specified characteristic. The Quality Control Plan establishes the frequency of inspection based on process control data.

c. One hundred percent (100%) - Test performed on the total length of each wire. Tests may be performed on the finished product or "in process" as applicable.

d. Qualification (Q) - Test performed only at the time of initial qualification or requalification.

4.4 TEST METHODS

4.4.1 Abrasion Resistance

Abrasion resistance shall be quantified as the number of scrape cycles required for a blade to abrade through the insulation of a finished wire and contact the stranded conductor within. The blade shall be a 90-degree wedge of tungsten carbide, with its edge rounded to a radius of 0.0050 ± 0.0005 inch *(.127 ± .0127 mm)*. The wire sample shall be fully supported so as not to bow or otherwise deflect from the force of the blade. Means shall be provided to apply an adjustable downward force through the blade onto the wire. The wire shall be scraped longitudinally along its axis while in contact with the blade, and an electrical detection circuit and counter mechanism shall be used to stop the test and record

the number of cycles when electrical contact has occurred. One such fixture is shown in Figure 1.

4.4.1.1 *Abrasion Procedure*

One inch *(25 mm)* of insulation shall be removed from a minimum 60-inch *(152-cm)* finished wire sample and connected to the detection circuit. The wire shall be firmly clamped in the fixture, and a mass of 1,000 grams shall be carefully applied to the surface of the insulation through the blade. The fixture stroke length shall be 0.375 ± 0.02 inch *(9.5 ± 0.5mm)* and the frequency shall be 55 ± 1 cycles per minute (2 scrapes = 1 cycle). Eight tests shall be performed, with the wire advanced in the fixture 6 inches *(152 mm)* and rotated 90 degrees between each test. The average number of cycles to electrical contact shall equal or exceed the minimum requirement specified on the applicable specification sheet.

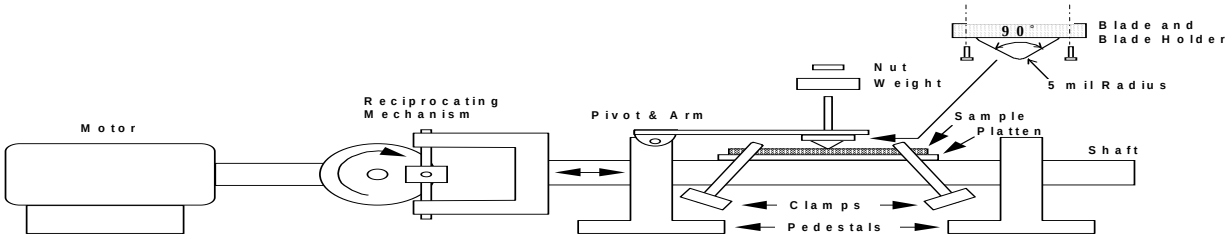

FIGURE 1. SCRAPE ABRASION TESTER

4.4.2 Cold Bend

One end of a finished wire specimen 24 inches in length shall be secured to a rotatable 2-inch mandrel in a cold chamber and the other end to a 3 pound load weight. Provision shall be made for rotating the mandrel by means of a handle or control located outside the chamber. The specimen of wire and the mandrel shall be conditioned for 4 hours at -40°C ± 2°C. At the end of this period and while both mandrel and specimen are still at this low temperature, the specimen shall be wrapped helically with adjacent turns in contact, for its entire length around the mandrel without opening the chamber. The bending shall be accomplished at a uniform rate of 2 ±1 RPM. At the completion of this test the specimen shall be removed from the cold box and from the mandrel without straightening. The specimen shall be examined for cracks in the insulation. The specimen shall then be straightened, the insulation removed for a distance of 1 inch from each end, and the specimen shall then subjected to the voltage withstand test specified in 4.4.17 herein.

4.4.3 Crosslink Proof Test

A 12-inch *(305mm)* specimen of the finished wire shall be suspended for one hour in an air circulating oven at 200°C. After conditioning, the specimen shall be removed, cooled to room temperature, and visually examined for evidence of melting or flowing.

4.4.4 Current Overload - Single Wire

The entire length of a 9 inch specimen of finished wire shall be spirally wrapped with a solid 18 AWG uninsulated conductor using a lay of 0.75 inches with sufficient length at each end to perform the following voltage withstand test. The wrap shall be tight fitting over the wire insulation without causing appreciable surface indentation.

A 0.5 inch length of insulation shall be stripped from each end of the specimen, and the conductor shall be terminated with ring lugs. The specimen shall then be securely attached to the power supply test equipment and shall be positioned horizontally. A DC current of 135 Amps shall then be applied for three minutes. After cooling down, the wire shall be subjected to a 1000 volt rms, 50 or 60 Hz potential applied between the conductor and the 18 AWG wire that is wrapped over the insulation for 5 minutes.

4.4.5 Current Overload - Bundle

Six 9 inch sample lengths of finished wire shall be tightly twisted with a left-hand lay and a lay length of 10 inches or less around a 10 inch core wire. The ends of this wire bundle shall be bound with 1/2 inch wide glass cloth tape. Strip 0.5 inch of insulation from each end of the center conductor only, terminate with ring lugs, and apply a DC current of 135 amps to the center wire for seven minutes. The bundle test specimen shall be observed during the current application period for the evolution of visible smoke, insulation melting, or other deleterious effects. After the seven minute current application period, the wire bundle shall be manually twisted apart, and the inside and outside of the wire bundle shall be visually examined against the requirements of 3.3.7.

4.4.6 Flammability

4.4.6.1 *Test Apparatus*

The test shall be performed within a test chamber approximately 1 ft *(0.3 m)* square by 2 ft *(0.6 m)* in height, open at the top and front to provide adequate ventilation for combustion but to prevent drafts. The specimen holder shall be so designed that the lower end of a 24-in *(600-mm)* specimen is held by a clamp, while the upper end of the specimen passes over a pulley and can be suitably weighted to hold the specimen taut at an angle of 60 degrees with the horizontal, in a plane parallel to and approximately 6 in *(150 mm)* from the back of the chamber. The test flame shall originate from a Bunsen type gas burner with a 0.250 in *(6 mm)* inlet, a needle valve in the base for gas adjustment, a nominal bore of 0.375 in *(9.5 mm)*, and a barrel length of approximately 4 in *(100 mm)* above the air inlets. The burner shall be adjusted to furnish a 3 in *(75 mm)* high conical flame with an inner cone approximately 1 in *(25 mm)* in length and a flame temperature not less than 954°C at its hottest point, as measured with an accurate thermocouple pyrometer. A sheet of facial tissue shall be suspended taut and horizontal 9.5 in *(240 mm)* below the point of application

of the flame to the specimen and at least 0.50 in *(13 mm)* from the chamber floor, so that any material dripping from the specimen shall fall upon the tissue.

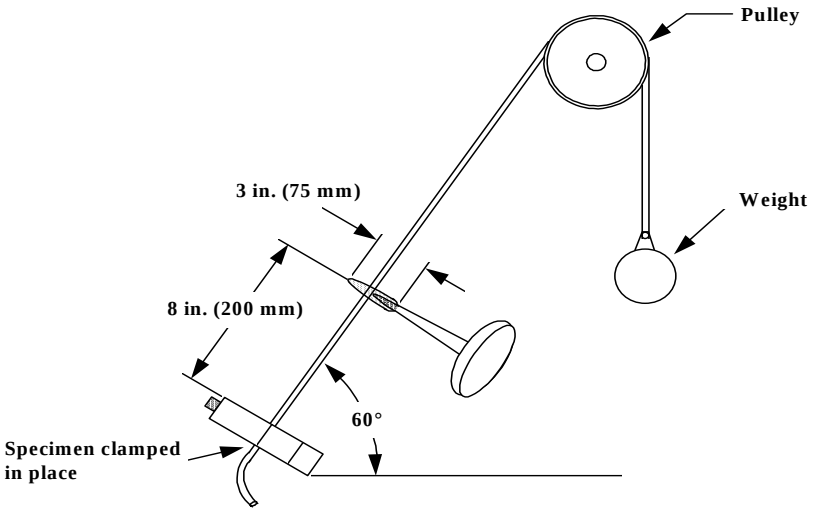

Figure II: Flammability Test Apparatus (shown without chamber)

4.4.6.2 *Test Procedure*

A 24 in *(600 mm)* specimen shall be marked at a distance of 8 in *(200 mm)* from its lower end to indicate the point for flame application and shall be placed in the specified 60 degree position in the test chamber. The lower end of the specimen shall be clamped in position in the specimen holder and the upper end shall be passed over the pulley of the holder and the applicable weight shall be attached. With the burner held perpendicular to the specimen and at an angle of 30 degrees from the vertical plane of the specimen (see Figure II), the hottest portion of the flame shall be applied to the lower side of the specimen at the test mark. The period of test flame application shall be 30 seconds and the test flame shall be withdrawn immediately at the end of that period. The distance of flame travel upward along the specimen from the test mark and the time of burning after removal of the test flame shall be recorded; also the presence or absence of flame in the facial tissue due to incendiary dripping from the specimen. Charred holes or charred spots in the tissue shall be ignored in the absence of actual flame. Breaking of the wire specimens shall not be considered as failure, provided the requirements for flame travel limits, duration of flame, and the absence of incendiary dripping are met. The apparatus and procedure above conform to FAR, Part 25, Appendix F (g) except that the facial tissue is not required.

4.4.7 Insulation Resistance

The ends of a wire specimen at least 26 feet in length shall be connected electrically to a DC terminal. The specimen shall be immersed in a water bath, at 25 ±5°C (77 ±9°F), containing 0. 5 to 1.0 percent of an anionic wetting agent, except that the electrical contacts

and approximately six inches of insulated wire at each end of the specimen shall protrude above the surface of the water. After 4 hours minimum of immersion, the specimen shall be subjected to a potential of 500 volts applied between the conductor and the water bath, which serves as the second electrode. The insulation resistance of the specimen shall be calculated to megohms for 1000 feet as follows:

$$IR = \frac{R \times L}{1000}$$

Where:

IR = Insulation resistance in megohms for 1,000 feet
R = Specimen resistance in megohms
L = Immersed sample length in feet

4.4.8 Insulation Resistance - Elevated Temperature In Water

The center 20 foot section of a 24 foot sample of finished wire shall be immersed into a water bath maintained at 90°C ±2°C (194°F ±4°F) with a 600 volt rms, 50 or 60 Hz potential applied continuously between the conductor and the water (except when insulation resistance measurements are taken). Insulation resistance shall be measured at temperature after one week of conditioning according to paragraph 4.4.7 herein with the exception of sample length.

4.4.9 Insulation Resistance - Elevated Temperature in Air

A 25 foot length of finished wire shall be covered with a tight fitting metal braid with 90% minimum coverage and then formed into a loose coil. The coil shall then be placed in an air circulating oven, with 2 foot leads taken out at a convenient port, and conditioned for 24 hours at 150°C ±2°C (302°F ±4°F). While the specimen is still in the 150°C oven, insulation resistance shall be measured using a suitable megohmeter after applying 500 volts DC for a period of one minute. The instrument shall be connected to the center conductor and the ground potential lead connected to the shield. The insulation resistance shall be calculated per 4.4.7 herein.

4.4.10 Insulation Tensile Strength and Ultimate Elongation

Testing of insulation tensile strength and ultimate elongation shall be performed in accordance with ASTM D 3032, section 17, with the following conditions and exceptions:

a) Samples shall be conditioned for 15 minutes at 160°C.

b) Crosshead speed (jaw separation rate) shall be 2 inches *(50 mm)* per minute.

c) Initial jaw separation shall be 1 inch *(25 mm)*.

4.4.11 Materials and Construction

Verification of materials and construction shall be performed at the appropriate stages of the manufacturing process.

4.4.12 Oil Resistance I

Test specimens and test procedure shall be in accordance with ICEA S-66-524 Paragraphs 6.4.7 and 6.4.12.4 with the following exceptions:

a) The sample shall be pre-conditioned according to 4.4.10a, herein.

b) IRM 902 oil shall be maintained at 150±2°C (302°F).

c) One set of three specimens shall be immersed for 6 days.

d) Values of tensile strength and elongation after immersion shall be averaged for each set. Percent retention levels shall be determined based on measurements performed on a set of unconditioned specimens.

4.4.13 Oil Resistance II

A 2-foot sample of finished wire shall be prepared for immersion. The diameter shall be measured at the midpoint of the sample length. The sample shall be immersed in 150°C±2°C (302°F±4°F) IRM 902 oil to within 6-inches from the ends of the insulation for 100 hours. Upon removal from the oil, the whole wire shall be blotted with absorbent tissue and the diameter at the midpoint of the wire measured. The diameter swell shall be defined as shown below. Following the swell measurement, the specimen shall then be subjected to the voltage withstand test specified in 4.4.17 herein.

$$\%Swell = 100 \times \frac{(D_1 - D_0)}{D_0}$$

Where:

D_1 = Post-immersion outer diameter
D_0 = Pre-immersion outer diameter

4.4.14 Shrinkage

A 24 inch sample length of finished wire shall be cut flush and straight at the sample ends. The sample shall be formed into a loose coil and conditioned in a circulating air oven at 170°C for 168 hours. Following the conditioning period, the sample shall be removed from the oven and allowed to cool for at least one hour at room temperature. The center portion of the sample shall then be wrapped for six turns around a 3/8-inch metal mandrel. The length of exposed conductor at both ends of the specimen shall be measured. The largest measured value shall not exceed the value specified in the specification sheet.

4.4.15 Thermal Aging - Insulation Resistance

A minimum 26 foot length of finished wire shall be conditioned in a circulating air oven for 7 days (168 hours) at 170°C. Following the oven exposure, the coil of wire shall be allowed to cool to room temperature for at least one hour and shall then pass the voltage withstand test of 4.4.17 herein, and the insulation resistance test of 4.4.7 herein.

4.4.16 Thermal Aging - Cold Bend

After conditioning a 72-inch sample coil of finished wire for 7 days (168 hours) at 170°C, the test coil shall be cut into three equal length specimens which shall then pass the cold bend test of 4.4.2 herein.

4.4.17 Voltage Withstand

Unless otherwise specified the sample shall be a 2-foot length of finished wire. The uninsulated ends of the specimen shall be attached to an electric lead. The specimen shall be immersed in a 5-percent, by weight, solution of sodium chloride in water at 20 to 25°C, except that the uninsulated ends and 1.5 inches *(38 mm)* of insulated wire at each end of the specimen shall protrude above the surface of the solution. After immersion for 4 hours, a 4.5 kV rms, 50 or 60 Hz potential shall be applied between the conductor and an electrode in contact with the liquid. The voltage shall be gradually increased at a uniform rate from zero to 4.5 kV rms in 0.5 minute, maintained at that voltage for a period of 5 minutes, and gradually reduced to zero in 0.5 minute.

4.4.18 Weight

The weight of each lot of finished wire shall be determined by Procedure I (4.4.18.1). Lots failing to meet the weight requirement of the applicable specification sheet when tested in accordance with Procedure I shall be subjected to Procedure II (4.4.18.2). All reels or spools failing to meet the requirements of the applicable specification sheet when tested to Procedure II shall be rejected.

4.4.18.1 *Procedure I*

A length of finished wire, sufficient to produce a measured weight to at least 3 significant figures, shall be weighed and converted to the weight per unit length shown on the applicable specification sheet.

4.4.18.2 *Procedure II*

The net weight of the finished wire on each reel or spool shall be obtained by subtracting the tare weight of the reel or spool from the gross weight of the reel or spool containing the finished wire. The net weight of wire on each reel or spool shall be divided by the accurately determined length of finished wire on that reel or spool and the resultant figure converted to pounds per 1000 feet *(kg/km)*. When wood or other moisture absorbent materials are used for reel or spool construction, weight determinations shall be made under substantially uniform conditions of relative humidity.

4.4.19 Workmanship

All details of workmanship shall be in accordance with high-grade wire and cable manufacturing practice. The insulation shall be free of cracks, splits, irregularities, and imbedded foreign material.

5. PREPARATION FOR DELIVERY

5.1 PACKAGING

Unless otherwise specified on the purchase order, all wire shall be supplied on reels, spools or bulk packaging. Each container shall be identified with the following information:

Specification Part Number
Lot Number
Quantity in Feet *(or Meters)*
Raychem Corporation *(Raychem Ltd.)*

6. NOTES

6.1 ORDERING DATA

Procurement documents should specify the following:

a. Title, number, and date of this specification
b. Applicable specification sheet part number
c. Quantity
d. Special preparation for delivery requirements, if applicable

6.2 ALTERNATIVE UNITS OF MEASURE

Where units of measure in this specification are followed by italicized alternative units of measure in parentheses, these alternative units may be substituted.