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UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Development Utilities Program (RDUP) - Telecommunications

BULLETIN 1755-601(PE-XX)

SUBJECT: **RDUP Specification for Fiber Optic Service Entrance Cables**

TO: All Telephone Borrowers
RDUP Telephone Staff

EFFECTIVE DATE:

EXPIRATION DATE: Date of change in 7 CFR 1755.900 by rulemaking.

OFFICE OF PRIMARY INTEREST: Technical Support Branch, Advance Services Division.

PURPOSE: This specification covers RDUP requirements for fiber optic service entrance cables intended for aerial installation either by attachment to a support strand or by an integrated self-supporting arrangement; for underground application by placement in a duct, or for buried installations by trenching, direct plowing, and directional or pneumatic boring. Cable meeting this specification is recommended for fiber optic service entrances having 12 or fewer fibers with distances less than 100 meters (300 feet), unless RDUP approves the suitability of the cable for other applications under this specification. Otherwise, RDUP recommends using PE-90 cable for applications greater than 100 meters and with more than 12 fibers.

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Cable, Fiber Optic Service Entrance, Telecommunications

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ABBREVIATIONS

ASTM	American Society for Testing and Materials
°C	Centigrade temperature scale
dB	Decibel
dB/km	Decibels per 1 kilometer
ECCS	Electrolytic chrome coated steel
EIA	Electronic Industries Association
EIA/TIA	Electronic Industries Association/ Telecommunications Industry Association
GE	General Electric
HD	High density polyethylene
LDHMW	Low density, high molecular weight polyethylene
LLDHMW	Liner low density, high molecular weight polyethylene
Max.	Maximum
MD	Medium density polyethylene
MHz-km	Megahertz-kilometer
Min.	Minimum
NA	Numerical aperture
NESC	National Electrical Safety Code
OC	Optical cable
OF	Optical fiber
OSHA	Occupational Safety and Health Administration
%	Percent
ps/(nm·km)	Picosecond per nanometer times kilometer
ps/(nm^2·km)	Picosecond per nanometer squared times kilometer
REA	Rural Electrification Administration

DEFINITIONS

Bandwidth: The range of signal frequencies that can be transmitted by a communications channel with defined maximum loss or distortion. Bandwidth indicates the information-carrying capacity of a channel. For an optic fiber system bandwidth is usually given as its capacity to transmit information in a specific time period for a specific length, e.g., 10 Mbit/sec/km.

Cladding: A layer of glass or other transparent material fused to and concentrically surrounding the core. The cladding has a lower refractive index than the core, so light is internally reflected along the core.

Core: The central region of an optical waveguide or fiber through which light is transmitted.

Cutoff Wavelength: The shortest wavelength at which only the fundamental mode of an optical wavelength is capable of propagation.

Dispersion: The spreading out of light pulses as they travel in an optical fiber, proportional to length.

Graded Refractive Index Profile: Any index profile that varies smoothly with radius. Distinguished from a step refractive index profile.

Loose Tube Buffer: A protective tube loosely surrounding a cabled fiber, often filled with a gel.

Mode-Field Diameter: The diameter of the one mode of light propagating in a single mode fiber.

Multimode Fiber: An optical fiber which will allow more than one bound to propagate. It may be either a graded index or step index optical fiber.

Numerical Aperture (NA): An optical fiber parameter that indicates the angle of acceptance of light into a fiber.

Optical Fiber: Any fiber, made of dielectric material that guides light.

Optical Waveguide: Any structure capable of guiding optical power. In optical communications, the term generally refers to a fiber designed to transmit optical signals.

Single Mode Fiber: An optical fiber in which only one bound mode can propagate at the wavelength of interest.

Step Refractive Index Profile: An index profile characterized by a uniform refractive index within the core and a sharp decrease in refractive index at the core-cladding interface. It

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corresponds to a power-law profile with profile parameter, g, approaching infinity.

Tight Tube Buffer: A material tightly surrounding a fiber in a cable, holding it rigidly in place.

1. SCOPE

a This specification covers the requirement for fiber optic service entrance cables intended for aerial installation either by attachment to a support strand or by an integrated self-supporting arrangement, for underground application by placement in a duct, or for buried installations by trenching, direct plowing, directional or pneumatic boring. Cables meeting PE-90 are considered to be in compliance with this specification. Other designs may be acceptable if approved by the Technical Standards Committee A _Telecommunications.

(1) The optical waveguides are glass fibers having directly-applied protective coatings, and are called "fibers", herein. These fibers may be assembled in either loose fiber encased in one or several protective buffer tubes or ribbon bundles with a protective core tube,.

(2) Fillers, strength members, core wraps, and bedding tapes may complete the cable core.

(3) The core or buffer tubes containing the fibers and the interstices between the buffer tubes, fillers, and strength members in the core structure are filled with a suitable material or water swell-able elements to exclude water.

(4) The cable structure is completed by an extruded overall plastic jacket. This jacket may have strength members embedded in it, in some designs.

(5) For rodent or additional protection with direct buried installations RDUP recommends armor under the outer jacket.

(6) For self-supporting cable the outer jacket may be extruded over the support messenger and cable core.

(7) For detection purposes, the cable may have toning elements embedded or extruded with the outer jacket.

b The cable is fully color coded so that each fiber is distinguishable from every other fiber. A basic color scheme of twelve colors allows individual fiber identification. Colored tubes, binders, threads, striping, or markings provide fiber group identification.

c Cable manufactured to this specification must demonstrate compliance with the qualification testing requirements to ensure satisfactory end-use performance characteristics for the intended applications.

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d Optical cable designs not specifically addressed by this specification may be allowed if accepted by RDUP. Justification for acceptance of a modified design must be provided to substantiate product utility and long term stability and endurance.

e Tensile Rating: The cable shall have ratings that are no less than the tensile ratings indicated in paragraph 1.1.4, Tensile Rating, of Part 1 of the ICEA S-110-717-2003 (ANSI/TIA 472F000).

f For self-supporting fiber optic service entrance cables, manufacturers must specify the maximum span length for all three storm loading districts referenced in Section 25, Loading of Grades B and C, of the latest edition of NESC. Additionally, to ensure the proper ground clearance (typically 4.3 m or 14 feet) is maintained the end user should factor in the maximum sag under loaded conditions as well as height of attachment for each application.

g Minimum Bend Diameter: for cable under loaded and unloaded conditions, the cable shall have the minimum bend diameters indicated in paragraph 1.1.5, Minimum Bend Diameter, of Part 1 of the ICEA S-110-717-2003 (ANSI/TIA 472F000). For very small cables, manufacturers may specify fixed cable minimum bend diameters that are independent of the outside diameter.

h All cables sold to RDUP borrowers for projects involving RDUP loan funds under this specification must be accepted by RDUP Technical Standards Committee "A" (Telephone). For cables manufactured to this specification, all design changes to an accepted design must be submitted for acceptance. RDUP will be the sole authority on what constitutes a design change.

i RDUP intends that the optical fibers contained in the cables manufactured in accordance with this specification have characteristics that will allow signals, having a range of wavelengths, to be carried simultaneously.

2. OPTICAL FIBERS

a Optical fibers shall meet Part 2, Optical Fibers, of ICEA S-110-717-2003 (ANSI/TIA 472F000).

b Additionally, optical ribbon fibers shall meet Paragraph 3.3, Optical Fiber Ribbons, of Part 3 of ICEA S-110-717-2003 (ANSI/TIA 472F000).

3. BUFFER/COATING

a The optical fibers contained in a buffer tube (loose tube) loosely packaged must have a clearance between the fibers and the inside of the container sufficient to allow for thermal expansions without constraining the fibers. The protective container must be manufactured from a material having a coefficient of friction sufficiently low to allow the fibers free movement. The design may contain more than one tube. Loose buffer tubes must meet the requirements of Paragraph 3.2.1, Loose Buffer Tube Dimensions, of Part 3 of ICEA S-110-717-2003 (ANSI/TIA47F000).

b Optical fiber coating shall meet the requirements of Paragraph 2.4, Optical Fiber Coatings and Requirements, of Part 2 of ICEA S-110-717-2003 (ANSI/TIA 472F000).

c All protective coverings in any single length of cable must be continuous and be of the same material except at splice locations.

d The protective coverings must be free from holes, splits, blisters, and other imperfections and must be as smooth and concentric as is consistent with the best commercial practice.

e Repairs to the fiber coatings are not allowed.

f The loose tube coverings of each color and other fiber package types removed from the finished cable must meet the following shrinkback and cold bend performance requirements. The fibers may be left in the tube.

(1) Shrinkback: Testing must be conducted in accordance with ASTM D 4565-90a, Paragraph 14.1, using a talc bed at a temperature of 95°C. Shrinkback must not exceed 5 percent of the original 150 millimeter length of the specimen. The total shrinkage of the specimen must be measured.

(2) Cold Bend: Testing must be conducted on at least one tube from each color in the cable. Stabilize the specimen to -20 ± 1°C for a minimum of four hours. While holding the specimen and mandrel at the test temperature, wrap the tube in a tight helix ten times around a mandrel with a diameter not greater than five times the tube diameter. The tube must show no evidence of cracking when observed with normal or corrected-to-normal vision.

4. FIBER AND BUFFER TUBE IDENTIFICATION

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a Fibers within a unit and the units within a cable shall be identified as indicated in Paragraphs 4.2 and 4.3 of Part 4 of ICEA S-110-717-2003 (ANSI/TIA 472F000), respectively.

5. STRENGTH MEMBERS

a Combined strength of all the strength members must be sufficient to support the stress of installation and to protect the cable in service. Strength members shall meet Paragraph 4.4, Strength Members, of ICEA S-110-717-2003 (ANSI/TIA 472F000). Self supporting aerial cables using the strength members as an integral part of the cable strength must comply with Paragraph C.4, Static Tensile Testing of Aerial Self-Supporting Cables, of ANNEX C of ICEA S-110-717-2003 (ANSI/TIA 472F000).

b. Strength members may be incorporated into the core as a central support member or filler, as fillers between the fiber packages, as an annular serving over the core, as an annular serving over the intermediate jacket, embedded in the outer jacket or as a combination of any of these methods.

d The central support member or filler must contain no more than one splice per kilometer of cable. Individual fillers placed between the fiber packages and placed as annular servings over the core must contain no more than one splice per kilometer of cable. Cable sections having central member or filler splices must meet the same physical requirements as un-spliced cable sections.

e Notwithstanding what has been indicated in other parts of this document, in each length of completed cable having a metallic central member, the dielectric strength between the optional armor and the metallic center member must withstand at least 15 kilovolts direct current for 3 seconds.

6. FORMING THE CABLE CORE

a Protected fibers must be assembled with the optional central support member, and strength members in such a way as to form a cylindrical group or other acceptable core constructions and shall meet Paragraph 4.5, Assembly of Cables, of Part 4 of ICEA S-110-717-2003 (ANSI/TIA-472F000). Other acceptable cable cores include round, figure 8, flat or oval designs.

b The standard cylindrical group or core designs shall consist of 12 fibers or less.

c When threads or tapes are used as core binders, they must be colored either white or natural and must be a non-hygroscopic and non-wicking dielectric material. Water swell-able threads and tapes are permitted as indicated in Paragraph 7.a of this specification.

7. FILLING/FLOODING COMPOUNDS AND WATER BLOCKING ELEMENTS

a To prevent the ingress and migration of water through the cable and core, filling/flooding compounds or acceptable water blocking elements must be used.

(1) Filling compounds shall be applied into the interior of the loose fiber tubes and into the interstices of the core. When a core wrap is used, the filling compound must also be applied to the core wrap, over the core wrap and between the core wrap and inner jacket when required.

(2) Flooding compounds must be sufficiently applied between the optional inner jacket and armor and between the armor and outer jacket so that voids and air spaces in these areas are minimized. The use of floodant between the armor and outer jacket is not required when uniform bonding, per paragraph 10.j of this specification, is achieved between the plastic-clad armor and the outer jacket. Floodant must exhibit adhesive properties sufficient to prevent jacket slip when tested in accordance with the requirements of Paragraphs 7.26 through 7.26.2 of Part 7, TESTING, TEST METHODS, AND REQUIREMENTS, of ANSI/ICEA S-87-640-2005.

(3) Water blocking elements shall achieve equal or better performance in preventing the ingress and migration of water as compared to filling and flooding compounds. In lieu of a flooding compound, water blocking elements may be applied between the optional inner jacket and armor and between the armor and outer jacket to prevent water migration. The use of the water blocking elements between the armor and outer jacket is not required when uniform bonding, per Paragraph 10.j of this specification, is achieved between the plastic-clad armor and the outer jacket.

b The materials must be homogeneous and uniformly mixed; free from dirt, metallic particles and other foreign matter; easily removed; nontoxic and present no dermal hazards.

c The individual cable manufacturer must satisfy RDUP that the filling compound or water blocking elements selected for use is suitable for its intended application.

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(1) Filling/Flooding compound materials must be compatible with the cable components when tested in accordance with ASTM D 4568-86 at a temperature of 85°C.

(2) Water blocking elements must be compatible with the cable components when tested in accordance with Paragraph 7.16, Material Compatibility and Cable Aging Test, of Part 7 of ICEA S-110-717-2003 (ANSI/TIA-472F000).

8. CORE WRAP (OPTIONAL)

a At the option of the manufacturer, one or more layers of nonhygroscopic and nonwicking dielectric material may be applied with an overlap over the core.

b The core wrap(s) can be used to provide a heat barrier to prevent deformation or adhesion between the fiber tubes or can be used to contain the core.

c When core wraps are used, sufficient filling compound must be applied to the core wraps so that voids or air spaces existing between the core wraps and between the core and the inner side of the core wrap are minimized.

9. INNER JACKET (OPTIONAL)

a Inner jackets may be applied directly over the core or over the strength members. Inner jackets are optional.

b The inner jacket material and test requirements must be as for the outer jacket material per Paragraphs 12 of this specification, except that either black or natural polyethylene may be used. In the case of natural polyethylene, the requirements for absorption coefficient and the inclusion of furnace black are waived.

10. ARMOR (OPTIONAL - RODENT & ADDITIONAL DIRECT BURIED PROTECTION)

a A steel armor, plastic coated on both sides, is recommended by RDUP for direct buried service entrance cable in gopher areas manufactured under the provisions of this specification. Armor is also optional for duct and aerial cable as required by the purchaser. The plastic coated steel armor must be applied longitudinally directly over the core wrap or the intermediate jacket and shall have an overlapping edge.

b The uncoated steel tape must be electrolytic chrome coated steel (ECCS) with a thickness of 0.155 ± 0.015 millimeters.

c The reduction in thickness of the armoring material due to the corrugating or application process must be kept to a minimum and must not exceed 10 percent at any spot.

d The armor of each length of cable must be electrically continuous with no more than one joint or splice allowed per kilometer of cable. This requirement does not apply to a joint or splice made in the raw material by the raw material manufacturer.

e The breaking strength of any section of an armor tape, containing a factory splice joint, must not be less than 80 percent of the breaking strength of an adjacent section of the armor of equal length without a joint.

f For cables containing no floodant over the armor, the overlap portions of the armor tape must be bonded in cables having a flat, noncorrugated armor to meet the requirements of Paragraphs 16.a and 16.b of this specification. If the tape is corrugated, the overlap portions of the armor must be sufficiently bonded and the corrugations must be sufficiently in register to meet the requirements of Paragraphs 16.a and 16.b of this specification.

g The armor tape must be so applied as to enable the cable to pass the bend test as specified in Paragraph 16.b of this specification.

h The protective coating on the steel armor must meet the Bonding-to-Metal, Heat Sealability, Lap-Shear and Moisture Resistance requirements of Type I, Class 2 coated metals in accordance with ASTM B 736-92a.

i The ability of the plastic-clad metal to resist the flooding compound must be determined as required by ASTM D 4568-99 using a one meter length of coated steel which must be aged for 7 days at 68 ± 1°C. There must be no delamination of the coating from the steel at the conclusion of the test.

j When the jacket is bonded to the plastic coated armor, the bond between the plastic coated armor and the outer jacket must not be less than 525 newtons per meter over at least 90 percent of the cable circumference when tested in accordance with ASTM D 4565-90a. For cables with strength members embedded in the jacket, and residing directly over the armor, the area of the armor directly under the strength member is excluded from the 90 percent calculation.

11. OPTIONAL SUPPORT MESSENGER (AERIAL CABLE)

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a Integrated messenger(s) for self-supporting cable shall provide adequate strength to operate under the appropriate weather loading conditions over the maximum specified span.

(1) Manufacturers must specify the maximum span length for all three storm loading districts referenced in Section 25, Loading of Grades B and C, of the latest edition of NESC. Additionally, to ensure the proper ground clearance (typically 4.3 m or 14 feet) is maintained the end user should factor in the maximum sag under loaded conditions as well as height of attachment for each application.

12. OUTER JACKET

a The outer jacket must provide the cable with a tough, flexible, protective covering which can withstand exposure to sunlight, to atmosphere temperatures and to stresses reasonably expected in normal installation and service.

b The jacket must be free from holes, splits, blisters, or other imperfections and shall be as smooth and concentric as is consistent with the best commercial practice.

c Jacket materials shall meet the stipulations of Paragraph 5.4 of ANSI/ICEA S-87-640-2005. Jacket thickness shall have a 0.50mm minimum thickness over the core or over any radial strength member used as the primary strength element(s), 0.20mm when not use as the primary strength member, and 0.30mm over any optional toning elements.

e Jacket Repairs shall meet the stipulations of Paragraph 5.5, Jacket Repairs, of ICEA S-110-717-2003 (ANSI/TIA 472F000).

f Jacket Testing: The jacket shall be tested to determine compliance with requirements of this section. The specific tests for the jacket are depicted in Paragraphs 7.6 through 7.11.2 of Part 7, TESTING, TEST METHODS, AND REQUIREMENTS, of ANSI/ICEA S-87-640-2005.

13. SHEATH SLITTING CORD (OPTIONAL)

a A sheath slitting cord is optional.

b When a sheath slitting cord is used it must be nonhygroscopic and nonwicking or be rendered such by the filling or flooding compound, continuous throughout a length of cable and of sufficient strength to open the sheath over at least a one meter length without breaking the cord at a temperature of 23 ± 5°C.

14. IDENTIFICATION MARKER AND LENGTH MARKER

a Each length of cable must be permanently labeled either OPTICAL CABLE, OC, OPTICAL FIBER CABLE, or OF on the outer jacket and identified as to manufacturer and year of manufacture.

b Each length of cable intended for direct burial installation shall be marked with a telephone handset in compliance with the requirements of the Rule 350G of the National Electrical Safety Code (NESC).

c Mark the number of fibers on the jacket.

d The identification and date marking must conform with Paragraph 6.1, Identification and Date Marking, of ICEA S-110-717-2003 (ANSI/TIA 472F000).

e The length marking must conform with Paragraph 6.3, Length Marking, of ICEA S-110-717-2003 (ANSI/TIA 472F000).

15. OPTICAL PERFORMANCE

a The optical performance shall meet the requirements of Part 8, Finished Cable Optical Performance Requirements, of ANSI/ICEA S-87-640-2005.

16. MECHANICAL REQUIREMENTS

a Cable Testing: Cable designs under this specification shall meet the requirements of Part 7, Testing and Test Methods, of ICEA S-110-717-203 (ANSI/TIA-472F000) except for Paragraph 7.15 applicable to tight tube fibers.

b Bend Test: All cables manufactured in accordance with the requirements of this specification must be capable of meeting the following bend test without exhibiting an increase in fiber attenuation greater than 0.10 dB for single mode fibers and 0.40 dB for multimode fibers.

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(1) Measure the attenuation of dispersion-unshifted single mode fibers at 1310 ± 20 and 1550 ± 20 nanometers, dispersion-shifted single mode fibers at 1550 ± 20 nanometers and multimode fibers at 1300 ± 20 nanometers.

(2) After measuring the attenuation of the optical fibers, test the cable sample in accordance with EIA/TIA-455-37A, Test Condition E, Turns Test Level 3. The following detailed test conditions shall apply:

(a) Section 4.2 - Mandrel diameter must be 20 times the cable diameter. For very small cables, manufacturers may specify fixed cable minimum bend diameters that are independent of the outside diameter.

(b) Section 4.5 - Measure the attenuation increase of the wound sample at the test temperature and specified Wavelengths in accordance with EIA-455-20.

(c) Section 5.5.6 shall be used for armored cable to examine for physical damage after test.

(d) For self-supporting cable, the jacketed support messenger and connection web must be removed prior to testing.

(3) The cable may be allowed to warm to room temperature before visual inspection. the bent area of the cable must show neither visible evidence of fracture of the jacket nor delamination of the bond at the overlap and to the outer jacket in nonflooded cable. After removal of the jacket, there must be no visible evidence of fracture of the armor, when present, and of the components in the core.

17. PRECONNECTORIZED CABLE (OPTIONAL)

a At the option of the manufacturer and upon request by the purchaser, the cable may be factory terminated with connectors acceptable to RDUP.

b All connectors must be accepted by RDUP prior to their use.

18. ACCEPTANCE TESTING AND EXTENT OF TESTING

a The tests described in this specification are intended for acceptance of cable designs and major modifications of accepted designs. What constitutes a major modification is at the discretion of RDUP. These tests are intended to show the inherent capability of the manufacturer to produce cable products that have satisfactory performance characteristics, long life and long-term optical stability but are not intended as field tests.

b For initial acceptance, the manufacturer must submit:

(1) An original signature certification that the product fully complies with each section of this specification;

(2) Qualification Test Data for demonstrating that the cable meets the requirements of this specification;

(3) A set of instructions for handling the cable;

(4) OSHA Material Safety Data Sheets for all components;

(5) Agree to periodic plant inspections;

(6) RDUP Buy American Requirement. For each product for which RDUP acceptance as a domestic product is requested, the manufacturer must include a certification stating that the product complies with the following two domestic origin manufacture provisions:

a. Final assembly or manufacture of the product, as the product would be used by an RDUP borrower, is completed in the United States or eligible countries (currently, Mexico, Canada and Israel); and

b. The cost of United States and eligible countries' components (in any combination) within the product is more than 50 percent of the total cost of all components utilized in the product. The cost of non-domestic components (components not manufactured within the United States or eligible countries) which are included in the finished product must include all duties,

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taxes, and delivery charges to the point of assembly or manufacture

(7) Written user testimonials concerning performance of the product; and

(8) Other nonproprietary data deemed necessary by the Chief, Technical Support Branch (Telecommunications).

c For continued RDUP product acceptance, the manufacturer must submit an original signature certification that the product fully complies with each section of the specification and a certification stating weather the product will continue to meet the RDUP "Buy American" requirement of paragraph 18b(6) above for acceptance by September 30 every three years. The certification must be based on test data showing compliance with the requirements of this specification. The test data must have been gathered within 90 days of the submission and must be kept on files per paragraph 19a.

d Initial and re-qualification acceptance requests should be addressed to: Chairman, Technical Standards Committee "A" (Telecommunications),STOP 1550, Advanced Services Division, Rural Development Utilities Program, Washington, DC 20250-1550.

19. RECORDS OF OPTICAL AND PHYSICAL TESTS

a Each manufacturer must maintain suitable summary records for a period of at least 3 years of all optical and physical tests required on completed cable by this specification. The test data for a particular reel must be in a form that it may be readily available to RDUP upon request. The optical data must be furnished to the purchaser on a suitable and easily readable form.

b Measurements and computed values must be rounded off to the number of places or figures specified for the requirement according to E29-02e1.

20. MANUFACTURING IRREGULARITIES

a Repairs to the armor, when present, are not permitted in cable supplied to the end user under this specification. The armor for each length of cable must be tested for continuity using the procedures of ASTM D 4566-90.

b Minor defects in the inner and outer jacket (defects having a dimension of 3 millimeter or less in any direction) may be repaired by means of heat fusing in accordance with good commercial practices utilizing sheath grade compounds.

c Buffer tube repair is permitted only in conjunction with fiber splicing.

21. PACKAGING AND PREPARATION FOR SHIPMENT

a All cables meeting this specification shall comply with Paragraph 6.5, Packaging and Marking, of ICEA S-110-717-203 (ANSI/TIA-472F000).

b For cables shipped on reels:

(1) A circumferential thermal wrap or other means of protection complying with the requirements of Appendix A of this specification must be secured between the outer edges of the reel flange to protect the cable against damage during storage and shipment. This requirement applies to reels weighing more that 75 lbs. The thermal wrap is optional for reels weighing 75 lbs or less.

(2) Cable manufactured to the requirements of this specification must be sealed at the ends to prevent entrance of moisture.

(3) The end-of-pull (outer end) of the cable must be securely fastened to prevent the cable from coming loose during transit. The start-of-pull (inner end) of the cable must project through a slot in the flange of the reel, around an inner riser, or into a recess on the flange near the drum and fastened in such a way to prevent the cable from becoming loose during installation.

(4) Spikes, staples or other fastening devices must be used in a manner which will not result in penetration of the cable.

(5) The minimum size arbor hole must be 44.5mm (1.75 inch) shall admit a spindle without binding. Steel arbor hole liners may be used but must be accepted by REA prior to their use.

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(6) Each reel must be plainly marked to indicate the direction in which it should be rolled to prevent loosening of the cable on the reel.

(7) Each reel must be stenciled or lettered with the name of the manufacturer.

(8) The following information must be either stenciled on the reel or on a tag firmly attached to the reel:

OPTICAL CABLE
Number of Fibers
Armored or Nonarmored
Year of Manufacture
Name of Cable Manufacturer
Length of Cable
Reel Number
REA 7 CFR 1755.XXX

Example:

OPTICAL CABLE
4 fibers
Armored
XYZ Company
1050 meters
Reel Number 3
REA 7 CFR 1755,XXX

(9) When pre-connectorized cable is shipped, the splicing modules must be protected to prevent damage during shipment and handling. The protection method must be acceptable to REA prior to its use.

UNITED STATED DEPARTMENT OF AGRICULTURE
Rural Utilities Services

APPENDIX A

Thermal Reel Wrap Qualification

1. This test procedures described in this appendix are for qualification of initial and subsequent changes in thermal reel wraps

2. SAMPLE SELECTION: All testing must be performed on two 450 millimeter lengths of cable removed sequentially from the same fiber jacketed cable. This cable must not have been exposed to temperatures in excess of 38°C since its initial cool down after sheathing.

3. TEST PROCEDURE

3.1 Place the two samples on an insulating material such as wood.

3.2 Tape thermocouples to the jackets of each sample to measure the jacket temperature.

3.3 Cover one sample with the thermal reel wrap.

3.4 Expose the samples to a radiant heat source capable of heating the uncovered sample to a minimum of 71°C. A GE 600 watt photoflood lamp or an equivalent lamp having the light spectrum approximately that of the sun shall be used.

3.5 The height of the lamp above the jacket shall be 380 millimeters or an equivalent height that produces the 71°C jacket temperature on the unwrapped sample shall be used.

3.6 After the samples have stabilized at the temperature, the jacket temperatures of the samples shall be recorded after one hour of exposure to the heat source.

3.7 Compute the temperature difference between jackets.

3.8 For the thermal reel wrap to be acceptable to REA, the temperature difference between the jacket with the thermal reel wrap and the jacket without the reel wrap shall be greater than or equal to 17°C.