

**City of Fort Collins**

**Bid Proposal**

**5919**

**LP CABLE  
15kV Jacketed, 750KCM**

**BID DATE: 2:00 PM (Our clock ) May 23, 2005**

**CITY OF FORT COLLINS  
INVITATION TO BID  
BID #5919  
LP CABLE 15kVJacketed, 750KCM**

Sealed bids will be received and publicly opened at the office of the Director of Purchasing and Risk Management, PO Box 580, 215 North Mason St., 2nd floor, Fort Collins, Colorado 80524, at the time and date noted on the bid proposal and/or contract documents. If delivered, they are to be delivered to 215 North Mason Street, 2<sup>nd</sup> Floor, Fort Collins, Colorado 80524. If mailed, the address is P.O. Box 580, Fort Collins, 80522-0580.

**Bids must be received at the Purchasing Office prior to 2:00p.m. (our clock), May 23, 2005.**

**Special Instructions**

All bids must be properly signed by an authorized representative of the company with the legal capacity to bind the company to the agreement. Bids may be withdrawn up to the date and hour set for closing. Once bids have been accepted by the City and closing has occurred, failure to enter into contract or honor the purchase order will be cause for removal of supplier's name from the City of Fort Collins' bidders list for a period of twelve months from the date of the opening. The City may also pursue any remedies available at law or in equity. Bid prices must be held firm for a period of forty-five (45) days after bid openings.

Submission of a bid is deemed as acceptance of all terms, conditions and specifications contained in the City's specifications initially provided to the bidder. Any proposed modification must be accepted in writing by the City prior to award of the bid.

Only bids properly received by the Purchasing Office will be accepted. All bids should be clearly identified by the bid number and bid name contained in the bid proposal.

No proposal will be accepted from, or any purchase order awarded, to any person, firm or corporation in default on any obligation to the City.

Bids must be furnished exclusive of any federal excise tax, wherever applicable.

Bidders must be properly licensed and secure necessary permits wherever applicable.

Bidders not responding to this bid will be removed from our automated vendor listing for the subject commodities.

The City may elect where applicable, to award bids on an individual item/group basis or on a total bid basis, whichever is most beneficial to the City. The City reserves the right to accept or reject any and all bids, and to waive any irregularities or informalities.

Sales prohibited/conflict of interest: No officer, employee, or member of City Council, shall have a financial interest in the sale to the City of any real or personal property, equipment, material, supplies or services where such officer or employee exercises directly or indirectly any decision-making authority concerning such sale or any supervisory authority over the services to be rendered. This rule also applies to subcontracts with the City. Soliciting or accepting any gift, gratuity, favor, entertainment, kickback or any items of monetary value from any person who has or is seeking to do business with the City of Fort Collins is prohibited.

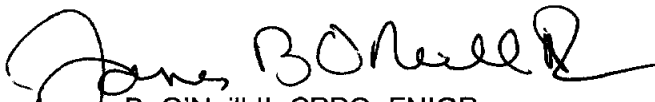
Freight terms: Unless otherwise noted, all freight is F.O.B. Destination, Freight Prepaid. All freight charges must be included in prices submitted on proposal.

Discounts: Any discounts allowed for prompt payment, etc., must be reflected in bid figures and not entered as separate pricing on the proposal form.

Purchasing restrictions: Your authorized signature of this bid assures your firm's compliance with the City's purchasing restrictions. A copy of the resolutions is available for review in the Purchasing Office or the City Clerk's Office. Request Resolution 91-121 for cement restrictions.

Collusive or sham bids: Any bid deemed to be collusive or a sham bid will be rejected and reported to authorities as such. Your authorized signature of this bid assures that such bid is genuine and is not a collusive or sham bid.

Bid results: For information regarding results for individual bids send a self-addressed, self-stamped envelope and a bid tally will be mailed to you. Bid results will be posted in our office 7 days after the bid opening.

  
James B. O'Neill II, CPPO, FNIGP  
Director of Purchasing and Risk Management

FIRM NAME \_\_\_\_\_

**CITY OF FORT COLLINS**  
**BID PROPOSAL**  
**BID # 5919**  
**BID OPENING: 2:00 p.m. – May 23, 2005**

WE HEREBY ENTER OUR QUOTE FOR THE CITY OF FORT COLLINS' REQUIREMENTS FOR **CABLE, UNDERGROUND, 15 kV, JACKETED** PER THE BID INVITATION AND ANY REFERENCED SPECIFICATIONS.

**QUANTITY**

**DESCRIPTION**

70,000 kFT

CABLE, UNDERGROUND, 15KV JACKETED 750KCMIL, 61 STRD., STRANDFILLED ALUMINUM CONDUCTOR, 100% INSULATION THICKNESS, COPPER CONCENTRIC NEUTRALS, AND FLEXIBLE ENCAPSULATING JACKET WITH THREE INTEGRAL RED STRIPES EXTRUDED PER FORT COLLINS SPECIFICATION 367 - 102, REVISION 1, SERIAL 04

\$ \_\_\_\_\_ kFt. \_\_\_\_\_ Total

Mfr. \_\_\_\_\_ Mfr.# \_\_\_\_\_

Delivery In Weeks: \_\_\_\_\_

**Bid shall be a firm bid without escalation.** All charges shall be included in the base cost shown

\*Any surcharges or additional costs shall be noted & included in bid submittal.

Delivery times may be evaluated in the award of this bid. Stated delivery will be expected to be met. Failure to perform can result in the removal of your firm from the City's bid list for up to three years.

ACCURATE GROSS REEL AND TARE WEIGHTS ARE CRITICAL.

- Please weigh empty reel, and verify weights prior to shipping.
- Averaged weights are unacceptable since specific cable is issued by foot per pound units.
- Refusal to comply with these terms may result in removal from the bidder's list for future orders.
- 51 EA. 1400 +/-25 FT REELS AND 3 EA. 1500 +/- FT REELS

The items being bid meet or exceed the attached specifications. Yes \_\_\_\_ No \_\_\_\_\_. If not, please list exceptions (specifying paragraph reference number) on a separate sheet of paper and attach to your bid documents.

For purposes of warranty and service ONLY approved manufacturers or distributors authorized by an approved manufacturer to serve the Fort Collins area may bid.

The City of Fort Collins reserves the right to split the bid in whatever percentages are most advantageous to the City.

Future orders of 15kV Jacketed, 750KCM cable may be authorized, at the option of the City, from this bid for a period of five years after date of award. Satisfactory pricing and delivery is required for future orders based on this bid.

**SUPPLEMENTAL INSTRUCTIONS**

Prices quoted must remain firm for a 30 day period after the opening date.

Freight terms: F.O.B. destination freight prepaid. All freight charges must be included in pricing submitted on proposal and not entered as separate pricing.

Any discount allowed by Vendor for prompt payment, etc. must be reflected in quoted figure, and not entered as separate pricing.

The City reserves the right to accept or reject any and all quotes.

Bidder not responding to the services requested in this bid shall be removed from our automated listing for: Not applicable

Any questions or inquiries regarding this bid should be directed to:

Opal F. Dick, CPPO, Senior Buyer  
(970) 221-6778

<hr/>	
SIGNATURE AND TITLE	TYPED OR PRINTED NAME AND TITLE
<hr/>	
COMPANY NAME	(AREA CODE) TELEPHONE NUMBER/FAX NUMBER
<hr/>	
ADDRESS: STREET, CITY, STATE, ZIP	DATE
<hr/>	

## Purchase Order Terms and Conditions

### **1. COMMERCIAL DETAILS.**

Invoice Address. To ensure prompt Payment mail invoices in duplicate to:

City of Fort Collins Accounting Division  
P.O. Box 580  
Fort Collins, CO 80522

Tax exemptions. By statute the City of Fort Collins is exempt from state and local taxes. Our Exemption Number is 98-04502. Federal Excise Tax Exemption Certificate of Registry 84-6000587 is registered with the Collector of Internal Revenue, Denver, Colorado (Ref. Colorado Revised Statutes 1973, Chapter 39-26, 114 (a).

Goods Rejected. GOODS REJECTED due to failure to meet specifications, either when shipped or due to defects of damage in transit, may be returned to you for credit and are not to be replaced except upon receipt of written instructions from the City of Fort Collins.

Inspection. GOODS are subject to the City of Fort Collins inspection on arrival.

Final Acceptance. Receipt of the merchandise, services or equipment in response to this order can result in authorized payment on the part of the City of Fort Collins. However, it is to be understood that FINAL ACCEPTANCE is dependent upon completion of all applicable required inspection procedures.

Freight Terms. Shipments must be F.O.B., City of Fort Collins, 700 Wood St., Fort Collins, CO 80522, unless otherwise specified on this order. If permission is given to prepay freight and charge separately, the original freight bill must accompany invoice. Additional charges for packing will not be accepted.

Shipment Distance. Where manufacturers have distributing points in various parts of the country, shipment is expected from the nearest distribution point to destination, and excess freight will be deducted from Invoice when shipments are made from greater distance.

Permits. Seller shall procure at sellers sole cost all necessary permits, certificates and licenses required by all applicable laws, regulations, ordinances and rules of the state, municipality, territory or political subdivision where the work is performed, or required by any other duly constituted public authority having jurisdiction over the work of vendor. Seller further agrees to hold the City of Fort Collins harmless from and against all liability and loss incurred by them by reason of an asserted or established violation of any such laws, regulations, ordinances, rules and requirements.

Authorization. All parties to this contract agree that the representatives are, in fact, bona fide and possess full and complete authority to bind said parties.

LIMITATION OF TERMS. This Purchase Order expressly limits acceptance to the terms and conditions stated herein set forth and any supplementary or additional terms and conditions annexed hereto or incorporated herein by reference. Any additional or different terms and conditions proposed by seller are objected to and hereby rejected.

### **2. DELIVERY.**

PLEASE ADVISE PURCHASING AGENT immediately if you cannot make complete shipment to arrive on your promised delivery date as noted. Time is of the essence. Delivery and performance must be effected within the time stated on the purchase order and the documents attached hereto. No acts of the Purchasers including, without limitation, acceptance of partial late deliveries, shall operate as a waiver of this provision. In the event of any delay, the Purchaser shall have, in addition to other legal and equitable remedies, the option of placing this order elsewhere and holding the Seller liable for damages. However, the Seller shall not be liable for damages as a result of delays due to causes not reasonably foreseeable which are beyond its reasonable control and without its fault of negligence, such acts of God, acts of civil or military authorities, governmental priorities, fires, strikes, flood, epidemics, wars or riots provided that notice of the conditions causing such delay is given to the Purchaser within five (5) days of the time when the Seller first received knowledge thereof. In the event of

any such delay, the date of delivery shall be extended for the period equal to the time actually lost by reason of the delay.

### **3. WARRANTY.**

The Seller warrants that all goods, articles, materials and work covered by this order will conform with applicable drawings, specifications, samples and/or other descriptions given, will be fit for the purposes intended, and performed with the highest degree of care and competence in accordance with accepted standards for work of a similar nature. The Seller agrees to hold the purchaser harmless from any loss, damage or expense which the Purchaser may suffer or incur on account of the Sellers breach of warranty. The Seller shall replace, repair or make good, without cost to the purchaser, any defects or faults arising within one (1) year or within such longer period of time as may be prescribed by law or by the terms of any applicable warranty provided by the Seller after the date of acceptance of the goods furnished hereunder (acceptance not to be unreasonably delayed), resulting from imperfect or defective work done or materials furnished by the Seller. Acceptance or use of goods by the Purchaser shall not constitute a waiver of any claim under this warranty. Except as otherwise provided in this purchase order, the Sellers liability hereunder shall extend to all damages proximately caused by the breach of any of the foregoing warranties or guarantees, but such liability shall in no event include loss of profits or loss of use. NO IMPLIED WARRANTY OR MERCHANTABILITY OR OF FITNESS FOR PURPOSE SHALL APPLY.

### **4. CHANGES IN LEGAL TERMS.**

The Purchaser may make changes to legal terms by written change order.

### **5. CHANGES IN COMMERCIAL TERMS.**

The Purchaser may make any changes to the terms, other than legal terms, including additions to or deletions from the quantities originally ordered in the specifications or drawings, by verbal or written change order. If any such change affects the amount due or the time of performance hereunder, an equitable adjustment shall be made.

### **6. TERMINATIONS.**

The Purchaser may at any time by written change order, terminate this agreement as to any or all portions of the goods then not shipped, subject to any equitable adjustment between the parties as to any work or materials then in progress provided that the Purchaser shall not be liable for any claims for anticipated profits on the uncompleted portion of the goods and/or work, for incidental or consequential damages, and that no such adjustment be made in favor of the Seller with respect to any goods which are the Sellers standard stock. No such termination shall relieve the Purchaser or the Seller of any of their obligations as to any goods delivered hereunder.

### **7. CLAIMS FOR ADJUSTMENT.**

Any claim for adjustment must be asserted within thirty (30) days from the date the change or termination is ordered.

### **8. COMPLIANCE WITH LAW.**

The Seller warrants that all goods sold hereunder shall have been produced, sold, delivered and furnished in strict compliance with all applicable laws and regulations to which the goods are subject. The Seller shall execute and deliver such documents as may be required to effect or evidence compliance. All laws and regulations required to be incorporated in agreements of this character are hereby incorporated herein by this reference. The Seller agrees to indemnify and hold the Purchaser harmless from all costs and damages suffered by the Purchaser as a result of the Sellers failure to comply with such law.

### **9. ASSIGNMENT.**

Neither party shall assign, transfer, or convey this order, or any monies due or to become due hereunder without the prior written consent of the other party.

### **10. TITLE.**

The Seller warrants full, clear and unrestricted title to the Purchaser for all equipment, materials, and items furnished in performance of this agreement, free and clear of any and all liens, restrictions, reservations, security interest encumbrances and claims of others.

**11. NONWAIVER.**

Failure of the Purchaser to insist upon strict performance of the terms and conditions hereof, failure or delay to exercise any rights or remedies provided herein or by law, failure to promptly notify the Seller in the event of a breach, the acceptance of or payment for goods hereunder or approval of the design, shall not release the Seller of any of the warranties or obligations of this purchase order and shall not be deemed a waiver of any right of the purchaser to insist upon strict performance hereof or any of its rights or remedies as to any such goods, regardless of when shipped, received or accepted, as to any prior or subsequent default hereunder, nor shall any purported oral modification or rescission of this purchase order by the Purchaser operate as a waiver of any of the terms hereof.

**12. ASSIGNMENT OF ANTITRUST CLAIMS.**

Seller and the Purchaser recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact borne by the Purchaser. Therefore, for good cause and as consideration for executing this purchase order, the Seller hereby assigns to the Purchaser any and all claims it may now have or hereafter acquired under federal or state antitrust laws for such overcharges relating to the particular goods or services purchased or acquired by the Purchaser pursuant to this purchase order.

**13. PURCHASERS PERFORMANCE OF SELLERS OBLIGATIONS.**

If the Purchaser directs the Seller to correct nonconforming or defective goods by a date to be agreed upon by the Purchaser and the Seller, and the Seller thereafter indicates its inability or unwillingness to comply, the Purchaser may cause the work to be performed by the most expeditious means available to it, and the Seller shall pay all costs associated with such work.

The Seller shall release the Purchaser and its contractors of any tier from all liability and claims of any nature resulting from the performance of such work.

This release shall apply even in the event of fault of negligence of the party released and shall extend to the directors, officers and employees of such party.

The Seller's contractual obligations, including warranty, shall not be deemed to be reduced, in any way, because such work is performed or caused to be performed by the Purchaser.

**14. PATENTS.**

Whenever the Seller is required to use any design, device, material or process covered by letter, patent, trademark or copyright, the Seller shall indemnify and save harmless the Purchaser from any and all claims for infringement by reason of the use of such patented design, device, material or process in connection with the contract, and shall indemnify the Purchaser for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution or after the completion of the work. In case said equipment, or any part thereof or the intended use of the goods, is in such suit held to constitute infringement and the use of said equipment or part is enjoined, the Seller shall, at its own expense and at its option, either procure for the Purchaser the right to continue using said equipment or parts, replace the same with substantially equal but non-infringing equipment, or modify it so it becomes non-infringing.

**15. INSOLVENCY.**

If the Seller shall become insolvent or bankrupt, make an assignment for the benefit of creditors, appoint a receiver or trustee for any of the Sellers property or business, this order may forthwith be canceled by the Purchaser without liability.

**16. GOVERNING LAW.**

The definitions of terms used or the interpretation of the agreement and the rights of all parties hereunder shall be construed under and governed by the laws of the State of Colorado, USA.

The following Additional Conditions apply only in cases where the Seller is to perform work hereunder, including the services of Sellers Representative(s), on the premises of others.

**17. SELLERS RESPONSIBILITY.**

The Seller shall carry on said work at Seller's own risk until the same is fully completed and accepted, and shall, in case of any accident, destruction or injury to the work and/or materials before Seller's final completion and acceptance, complete the work at Seller's own expense and to the satisfaction of the Purchaser. When materials and equipment are furnished by others for installation or erection by the Seller, the Seller shall receive, unload, store and handle same at the site and become responsible therefor as though such materials and/or equipment were being furnished by the Seller under the order.

**18. INSURANCE.**

The Seller shall, at his own expense, provide for the payment of workers compensation, including occupational disease benefits, to its employees employed on or in connection with the work covered by this purchase order, and/or to their dependents in accordance with the laws of the state in which the work is to be done. The Seller shall also carry comprehensive general liability including, but not limited to, contractual and automobile public liability insurance with bodily injury and death limits of at least \$300,000 for any one person, \$500,000 for any one accident and property damage limit per accident of \$400,000. The Seller shall likewise require his contractors, if any, to provide for such compensation and insurance. Before any of the Sellers or his contractors employees shall do any work upon the premises of others, the Seller shall furnish the Purchaser with a certificate that such compensation and insurance have been provided. Such certificates shall specify the date when such compensation and insurance have been provided. Such certificates shall specify the date when such compensation and insurance expires. The Seller agrees that such compensation and insurance shall be maintained until after the entire work is completed and accepted.

**19. PROTECTION AGAINST ACCIDENTS AND DAMAGES.**

The Seller hereby assumes the entire responsibility and liability for any and all damage, loss or injury of any kind or nature whatsoever to persons or property caused by or resulting from the execution of the work provided for in this purchase order or in connection herewith. The Seller will indemnify and hold harmless the Purchaser and any or all of the Purchasers officers, agents and employees from and against any and all claims, losses, damages, charges or expenses, whether direct or indirect, and whether to persons or property to which the Purchaser may be put or subject by reason of any act, action, neglect, omission or default on the part of the Seller, any of his contractors, or any of the Sellers or contractors officers, agents or employees. In case any suit or other proceedings shall be brought against the Purchaser, or its officers, agents or employees at any time on account or by reason of any act, action, neglect, omission or default of the Seller of any of his contractors or any of its or their officers, agents or employees as aforesaid, the Seller hereby agrees to assume the defense thereof and to defend the same at the Sellers own expense, to pay any and all costs, charges, attorneys fees and other expenses, any and all judgments that may be incurred by or obtained against the Purchaser or any of its or their officers, agents or employees in such suits or other proceedings, and in case judgment or other lien be placed upon or obtained against the property of the Purchaser, or said parties in or as a result of such suits or other proceedings, the Seller will at once cause the same to be dissolved and discharged by giving bond or otherwise. The Seller and his contractors shall take all safety precautions, furnish and install all guards necessary for the prevention of accidents, comply with all laws and regulations with regard to safety including, but without limitation, the Occupational Safety and Health Act of 1970 and all rules and regulations issued pursuant thereto.

**SPECIFICATION FOR**  
**15 KV, CONCENTRIC NEUTRAL, TREE-RETARDANT**  
**CROSS - LINKED POLYETHYLENE INSULATED, JACKETED CABLE**

**SPECIFICATION NO: 367-102**

**REV. I**

**April 2005**



THE CITY OF FORT COLLINS

Light and Power Department  
 P.O. Box 580  
 Fort Collins, CO 80522

SPECIFICATION NO: 367-102

15 KV, Concentric Neutral, Tree-Retardant  
 Cross - Linked Polyethylene Insulated, Jacketed Cable

APPROVED BY:   
 Craig Eader  
 Standards Engineer

ORIGINAL ISSUE: 6/20/92

REVISED: May 4, 2005

ITEMS COVERED BY THIS SPECIFICATION			
DESCRIPTION	DESIGN CODE		
	SPECIFICATION NO.	SERIAL	STORES NO.
1/0 AWG TRXLPE INSULATED CABLE W/ LLDPE JACKET	367-102	-01	7503-1093
750 kcmil TRXLPE INSULATED CABLE W/ LLDPE JACKET	367-102	-04	7503-1130

## REVISION DESCRIPTIONS

REVISION DESCRIPTION (Previous Revision Descriptions on File)	CHANGE NOTICE	APPROVED
NEW	6-19-92	Tim M. Sagen 6-19-92
<b>REVISION A:</b> <ul style="list-style-type: none"> <li>• Paragraph 3.2.2.10: Add jacket marked in accordance with NESC.</li> <li>• Paragraph 3.2.2.2 and 3.3.2: Change Union Carbide number from 0802 to 0800.</li> <li>• Paragraph 3.3.7: Define jacket shrink back 0.250.</li> <li>• Table IV: Add jacket shrink back references.</li> <li>• Paragraph 4.7.7.2: Add "insulation" to shrink back to differentiate from jacket shrink back.</li> <li>• Paragraph 4.7.7.3: Require aging before high voltage time test. Change step from 639 to 620v/mil.</li> <li>• Add paragraph 4.7.12: Jacket shrink back.</li> <li>• Appendix A: Delete Canada Wire and Reynolds, add Southwire and correct CABLEC's name.</li> <li>• Reissue</li> </ul>		Tim Sagen Sue Coram 5/4/93
<b>REVISION B:</b> <ul style="list-style-type: none"> <li>• Paragraph 3.3.7; 4.7.12 change jacket shrinkback from .25" to 100 mils.</li> <li>• Paragraph 3.2.2.9: change jacket shrinkback to match 3.3.&gt;</li> <li>• Paragraph 3.2.2.7: Correct DOI from .935 to .947.</li> <li>• Paragraph 3.1.1: add "-87" to AEIC standard on priority list.</li> </ul>		Tim Sagen Sue Coram 3/24/95
<b>REVISION C:</b> <ul style="list-style-type: none"> <li>• Updated Appendix A</li> </ul>		Tim Sagen Sue Coram 8/6/97
<b>REVISION D:</b> <ul style="list-style-type: none"> <li>• Reformatted (no reissue)</li> </ul>		Bill Bray 7/11/2000
<b>Revision E:</b> <ul style="list-style-type: none"> <li>• Completely revised to reflect ICEA S94-649-2000 and AEIC CS8-2000.</li> <li>• Insulation and shield thickness requirements are now specified using min and max points rather than minimum averages.</li> <li>• Changed insulation thickness on 750 kCM cable from 220 mils to 175 mils.</li> </ul>	1/16/02	Kraig Bader Tim Sagen
<b>Revision F:</b> <ul style="list-style-type: none"> <li>• 750 kcmil stock number on title page changed from 7503-1120 to 7503-1130</li> <li>• Rephrased "true triple extrusion" definition.</li> <li>• Changed Union Carbide Corporation to Dow Chemical.</li> <li>• Changed insulation codes in Table 11.</li> <li>• Changed the conductor shield compound to Dow Chemical HFDA-0802 from HFDA-0800. 0802 is the correct compound for aluminum conductors. Corrected General Cable's conductor shield number from LS-5502 to XFB-5502.</li> <li>• Flexible jacket material DFDB 6433 added to specification for use on 750kcmil cable.</li> <li>• Deleted the Insulation Heat Distortion Test.</li> <li>• Changed the number of reels requiring an insulation resistance test from all to three from each cable core extruder run.</li> </ul>	4/17/2002	Kraig Bader Tim Sagen 4/25/02

REVISION DESCRIPTION (Previous Revision Descriptions on File)	CHANGE NOTICE	APPROVED
<p>Revision G:</p> <ul style="list-style-type: none"> <li>750 kcmil Serial code changed to "04" in tables to reflect reference on page 2.</li> <li>Insulation shield thickness reduction values in Table 10 removed. Values are redundant and are already specified by Table 9.</li> </ul>	5/9/2002	Kraig Bader 5/9/2002 Tim Sagen
<p>Revision H</p> <ul style="list-style-type: none"> <li>Removed Equistar 320TR-XLPE insulation compound from the approved list. Equistar has ceased to manufacture medium voltage compounds. Amended Table 11 to reflect the change in insulation identification requirements.</li> <li>Removed optional "low density nonconductive, flexible polyethylene compound Dow Chemical compound number DFDB-6433 (367-102-04)" from the approved jacketing compounds.</li> </ul>		Kraig Bader 01/29/2003 Tim Sagen
<p>Revision I</p> <ul style="list-style-type: none"> <li>Adjusted product description from "15 KV Two Conductor Tree-Retardant Cross - Linked Polyethylene Insulated Jacketed Cable" to "15 KV, Concentric Neutral, Tree-Retardant Cross - Linked Polyethylene Insulated, Jacketed Cable"</li> <li>More clearly list the approved compounds for use in conductor shield, insulation, and insulation shield (Sections 3.2.2.2,</li> <li>Removed reference to Dow insulation compound preference over AT Plastics in 3.2.2.3</li> <li>Amended shipping instructions to remove the requirement for wooden lagging on the shipping reels. Several failures of new cable related to nail-holes indicate that the lagging installation step places the cable at risk.</li> </ul>		Kraig Bader 5/2/2005

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**SPECIFICATION FOR  
TWO-CONDUCTOR CROSS-LINKED POLYETHYLENE INSULATED CABLE**

## 1 SCOPE

This specification establishes the minimum requirements for two-conductor insulated, shielded, and jacketed concentric-neutral underground distribution cable, insulated with a thermosetting dielectric based on cross-linked polyethylene (XLP). Cable described herein is intended for 60 Hz, single and three-phase applications in wet or dry locations in conduit, underground duct systems, direct buried and aerial installations in open air in sunlight.

## 2 APPLICABLE DOCUMENTS

The following documents of the issue shown form a part of this specification to the extent specified herein. In those cases when the document is not dated, the latest issue in effect on the date of invitation for bids shall form a part of this specification.

2.1 AEIC NO. CS-8-2000 (1<sup>st</sup> Edition) -*Specifications for Extruded Dielectric , Shielded Power Cables Rated 5 through 46 kV*, first edition.

2.2 ICEA PUB. NO. S-94-649-2000 -*Standard for Concentric Neutral Cables Rated 5,000 – 46,000 Volts*.

### 2.3 OTHER STANDARDS

- Applicable ASTM standards
- Applicable ANSI standards
- Other applicable ICEA/NEMA standards

## 3 REQUIREMENTS

### 3.1 GENERAL REQUIREMENTS FOR DESIGN

#### 3.1.1 Basic Design Standards

Cables purchased under these specifications shall, unless otherwise specified, meet the requirements of AEIC No. CS8, applicable ANSI/ICEA Standards, and the modifications and additions given in the subsequent paragraphs. In case of conflict, the requirements of the following documents shall apply in the priority shown:

- 1) This specification.
- 2) AEIC No. CS8-2000
- 3) ANSI/ICEA S-94-649-2000
- 4) Other applicable ANSI, ICEA-NEMA and ASTM Standards.

#### 3.1.2 Temperature Ratings

The following maximum temperature ratings shall apply:

<b>Operating (Continuous)</b>	<b>Emergency Overload</b>	<b>Short Circuit</b>
90°C (194°F)	130°C (266°F)	250°C (482°F)

#### 3.1.3 General Construction

Cable covered by this specification consists of a blocked strand central conductor, conducting strand shielding layer, TRXLPE insulation, semi-conducting XLPE insulation shield, concentric neutral applied helically overall, and

an overall insulating thermoplastic jacket. The conductor shield, insulation, and insulation shield shall be applied to the conductor through a single crosshead in one manufacturing pass; i.e., true triple extrusion is required. The insulation compound shall be extra clean and transported and stored in contamination-free bulk handling systems. Insulation compound handling systems shall be closed systems approved by the City of Fort Collins. Systems shall subject 100% of the insulation compound to filtering and metal detectors to eliminate streamers, fines, off-color pellets, and ferrous and non-ferrous metal contaminants. The insulation and shield layers shall be cross-linked by a dry cure method approved by the City of Fort Collins.

#### 3.1.4 Guarantee

Seller warrants that cable furnished under these specifications is free of defects in material and workmanship, that it has been manufactured and tested in accordance with these specifications and that the results of said tests comply with the requirements of said specifications. Seller agrees to provide replacement product for (i) any cable found defective in material or workmanship regardless of the age of the cable, or (ii) any cable failing during normal and proper use within one year of the date of placing in service. The date of placing in service is the date on which operating voltage is first applied. All replacements shall be made free of charge, f.o.b. the delivery point called for in the original order. The requirements of paragraph 4.1 of this specification, requiring independent testing laboratory certification, shall in no way limit the liability of the vendor regarding the guarantee.

#### 3.1.5 Approved Manufacturers

Cable purchased under this specification shall be of the manufacturers listed in Appendix A. Only direct bids from approved manufacturers with current AEIC qualification test reports on file with the City of Fort Collins will be accepted. Manufacturers not listed may submit written proposals demonstrating compliance with these specifications for consideration of addition to the accepted manufacturers list prior to the next request for bids. In addition to inclusion on the list in Appendix A, manufacturer's cable must satisfy all requirements of this specification to be acceptable.

### 3.2 SPECIFIC REQUIREMENTS FOR DESIGN OF 367-102-01 and 367-102-04

#### 3.2.1 Functional Description

The cable shall be 15 kV triple extruded TRXLPE insulated, with concentric neutral and LLDPE (367-102, serial 01) or LDPE (367-102, serial 04) jacket, suitable for direct burial, for use on a 7.960/13.8kV grounded "Y" distribution system.

#### 3.2.2 Design and Construction

##### 3.2.2.1 Conductor

Stranded inner conductors shall be uncoated 1350 aluminum with no softer than an H-16 intermediate to hard temper and shall conform to Section 2 of ICEA S-94-649-2000 and ASTM B-609 and B-231. Stranding shall be concentric lay Class B compressed. The inner conductors shall be free of moisture, corrosion and excess drawing lubricant before, during and after processing.

The central conductor shall have the interstices of the strands filled to render the conductor impervious to longitudinal water transmission per ICEA Publication T-31-610 and shall meet a minimum requirement of 5 psig. The compound shall be flexible, stable, and compatible with the conductor, conductor shield, insulation, insulation shield, jacket, terminators, elbows, splices, and synthetic base oxide inhibitors throughout the conditions experienced during normal cable maintenance and operation (-40°C or lower to 130°C or higher). There shall be no trace of compound on the outside layer of the conductor strands.

The center conductor for 367-102-01 shall be compressed # 1/0 AWG, 19 strand aluminum.

The center conductor for 367-102-04 shall be compressed 750 kcmil, 61 strand aluminum.



### 3.2.2.2 Conductor Shielding

Conductor shielding shall be in accordance with section C of AEIC CS8-00 except as modified herein. The approved conductor shield compounds are listed below:

- a) Dow Chemical HFDA-0802 or
- b) General Cable XFB-5502

The conductor shield compound shall be extruded semi-conducting cross-linked polyethylene compound appropriate for the specific conductor material and insulation compound to be used in the cable construction. The conductor shield shall be non-adhering to the conductor but securely bonded to the insulation. The cable will be rejected if the interface between the strand shield and the insulation is not cylindrical, if it exhibits voids, bumps, protrusions, or irregularities in excess of 3 mils into the insulation or 7 mils into the conductor shield, or if visual inspection by the naked eye reveals that the interface is bumpy (i.e., polygonation is visible). Volume resistivity shall not exceed the values set forth in Table 1 of this specification.

**Table 1 – Conductor Shield Volume Resistivity**

Ambient Temperature	Volume Resistivity (ohm-m)
25°C	50 ohm-m
90°C	500 ohm-m
130°C	1000 ohm-m

Physical and aging requirements shall be in accordance with ICEA S-94-649-2000, except that the brittleness temperature shall be not warmer than -30°C. The conductor shielding shall also pass the wafer boil test of ICEA S94-649-2000, paragraph 9.4.12. Requirements for maximum allowable size and density of voids in the conductor shield shall be the same as the requirements for voids in the insulation.

If the compounds specified above are found to fail the physical requirements set forth in this document, the City of Fort Collins may disqualify them.

The thickness of the conductor shield at any location on the completed cable shall be in accordance with Table 2 of this specification.

**Table 2 – Conductor Shield Minimum Extrusion Thickness**

Specification	Cable Description	Conductor Shield Minimum Point
367-102-01	#1/0 AWG Aluminum	12 mils
367-102-04	750kcmil Aluminum	20 mils

### 3.2.2.3 Insulation

The approved insulation compounds are listed below:

- a) Dow Chemical HFDA-4202 or
- b) Dow Chemical HFDB-4202

The insulation shall be extruded Dow Chemical HFDA 4202 or Dow Chemical HFDB-4202 tree retardant cross-linked thermosetting polyethylene having a minimum and maximum thickness as defined in Table 3 of this specification. The maximum eccentricity (thickness at maximum point minus thickness at minimum point) shall comply with Table 3 of this specification. Nominal thickness is shown in Table 3 for reference purposes only.

**Table 3 – Insulation Thickness**

Specification	Cable Description	Nominal Insulation Thickness	Insulation Minimum Point	Insulation Maximum Point	Maximum Eccentricity
367-102-01	#1/0 AWG Aluminum	220 mils	210 mils	250 mils	30 mils
367-102-04	750kcmil Aluminum	175 mils	165 mils	205 mils	30 mils

The insulation shall meet the requirements of AEIC CS8-00, Section D. The electrical and physical characteristics shall be in accordance with ICEA S94-649-2000, paragraph 4.3.1.2. The insulation shall not contain voids larger than 3 mils. The number of voids larger than 2 mils shall not exceed 30 per cubic inch. Contaminants shall not exceed 5 mils in their greatest dimension, and shall number no greater than 15 per cubic inch. The insulation shall be free of ambers, gels, or agglomerates larger than 10 mils.

### 3.2.2.3.1 Alternating-Current Voltage

The insulation of completed cable shall withstand the alternating-current test voltage shown in Table 4 of this specification for five (5) minutes.

**Table 4 – AC Test Voltage**

Specification	Cable Description	AC Test Voltage (kV)
367-102-01	#1/0 AWG Aluminum	44
367-102-04	750kcmil Aluminum	35

### 3.2.2.3.2 Insulation Resistance

The insulated conductor shall have an insulation resistance not less than that corresponding to a constant (K) of 30,000 at 15.6°C (60°F) per the table in ICEA T-27-581 for converting insulation resistance, using a coefficient of 1.03.

### 3.2.2.3.3 Partial Discharge

Partial discharge of each shipping reel of completed cable shall not exceed five (5) picocoulombs during any portion of the partial discharge test specified in ICEA S-94-649-2000.

### 3.2.2.4 Diameter Over Insulation

The diameter over the insulation anywhere along the cable length shall conform to the values listed in Table 5 of this specification. The diameters in Table 5 are consistent with the requirements in Appendix 2 of AEIC CS8-00 and differ from those shown in ICEA.

**Table 5 –Diameter Over Insulation**

Specification	Cable Description	Nominal Insulation Thickness	Diameter Over Insulation (inches)
367-102-01	#1/0 AWG Aluminum	220 mils	0.860 ± 30 mils
367-102-04	750kcmil Aluminum	175 mils	1.400 ± 30 mils

### 3.2.2.5 Insulation Shielding (Insulation Screen)

The approved insulation shield compounds are listed below:

- a) Dow Chemical HFDA-0693 or
- b) General Cable LS-567A

The insulation shielding shall be extruded, black, semi-conductive, cross-linked polyethylene, complying with the physical and aging characteristics for discharge free thermoset shields in section 5.4 of ICEA S-94-649-2000, except that the brittleness temperature shall be not warmer than -30°C. The insulation shielding shall be appropriate for and compatible with the specific insulation compound to be used in the cable construction and shall be free stripping. The insulation shield shall have minimum and maximum thickness limits as detailed in Table 6 of this specification.

**Table 6 – Insulation Shield Minimum and Maximum Extrusion Thickness**

Specification	Cable Description	Insulation Shield Minimum Point (mils)	Insulation Shield Maximum Point (mils)
367-102-01	#1/0 AWG Aluminum	30	60
367-102-04	750kcmil Aluminum	40	75

The insulation shield volume resistivity shall not exceed the values in Table 7 of this specification.

**Table 7 – Insulation Shield Volume Resistivity**

Ambient Temperature	Volume Resistivity (ohm-m)
25°C	50 ohm-m
90°C	500 ohm-m
110°C	500 ohm-m

All other requirements shall be in accordance with AEIC No. CS8 Section E, except that the minimum stripping force shall be six (6) pounds. Stripping tensions outside the 6-24 pound requirement are unacceptable regardless of the results of any repeat test.

### 3.2.2.6 Diameter Over Shield

The diameter over the insulation shielding anywhere along the cable length shall conform to the values listed in Table 8 of this specification. The diameters in Table 8 are consistent with the requirements in Appendix 2 of AEIC CS8-00 and differ from those shown in ANSI/ICEA.

**Table 8 –Diameter Over Insulation Shield**

Specification	Cable Description	Nominal Insulation Thickness	Diameter Over Insulation Shield (inches)
367-102-01	#1/0 AWG Aluminum	220 mils	0.940 ± 50 mils
367-102-04	750kcmil Aluminum	175 mils	1.50 ± 50 mils

### 3.2.2.7 Concentric Neutral

A concentric neutral consisting of bare solid untinned soft-drawn copper wires shall be spirally wrapped over the insulation shield with uniform spacing between the wires and shall meet the provisions of Sections 2 and 6 of ICEA S-94-649-2000 and applicable ASTM standards. Neutral wires shall be sized according to Table 9 of this specification. They shall be in firm contact with the insulation shield, shall not cause indentations in the primary insulation and shall indent the insulation shield no more than specified in Table 9 of this specification. The length of the lay of the concentric wires shall be not less than six (6) times and not more than ten (10) times the diameter over the concentric wires.

**Table 9 – Concentric Neutral Requirements**

Specification	Cable Description	Number and Size of Concentric Neutral Wires	Maximum allowable Concentric neutral Indent (mils)
367-102-01	#1/0 AWG Aluminum	Sixteen (16) #14 AWG Cu (Full Neutral)	15
367-102-04	750kcmil Aluminum	Nineteen (19) #14AWG Cu (One-Sixth Neutral)	15

### 3.2.2.8 Jacket

The jacket shall be a linear low density, nonconductive, high molecular weight polyethylene compound (367-102-01). Both compounds must meet or exceed the requirements in ICEA S-94-649-2000, Section 7.1, and shall have a maximum and minimum thickness as defined in Table 10 of this specification. The jacket shall encapsulate all neutral wires and fill all the space around insulation shield, and shall be free stripping from the insulation shield and the neutral wires. The jacket shall be smooth and uniform, free of blisters, cracks and

holes. Application of the jacket shall not cause concentric neutral indentation of the insulation shield in excess of that shown in Table 9.

**Table 10 – Jacket Requirements**

Specification	Cable Description	Jacket Minimum Point	Jacket Maximum Point	Jacket Shrinkback
367-102-01	#1/0 AWG Aluminum	40	70	300 mils
367-102-04	750kcmil Aluminum	40	70	300 mils

Total combined linear shrinkage of the jacket shall not exceed the values listed in Table 10 when tested in accordance with paragraph 4.7.12 of this specification. The jacket shall not alter its physical or electrical properties from exposure to sunlight or the elements.

### 3.2.2.9 Cable Identification

Cable identification is required on the insulation shield and jacket and shall be in accordance with ICEA S-94-649-2000. In addition, the cable shall be durably marked with sequential footage marking printed directly on the jacket. The footage marking shall be printed at least every two (2) feet. The footage marking on the mandrel end of the cable shall be permanently marked on the reel. The insulation compound used shall be indicated on the jacket using the codes in Table 11 of this specification for the insulation compounds approved by the City of Fort Collins:

**Table 11 - Insulation Code for jacket markings**

Insulation Code	Insulation Compound Description
4202A	Dow Chemical HFDA 4202
4202B	Dow Chemical UCC HFDB 4202

The NESC identification symbols for supply cables shown in Figure 350-1 of ANSI C2 latest edition of the "National Electrical Safety Code" shall be indented or embossed in the outermost cable jacket. The jacket shall be permanently marked with three red stripes equally spaced around the entire length. The red stripes, measuring a nominal 0.250" wide by .010" deep shall be extruded into and become an integral part of the black jacketed cable surface.

## 4 QUALITY ASSURANCE

### 4.1 RESPONSIBILITY FOR INSPECTION

Unless otherwise specified, the vendor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the vendor may utilize his own facilities or any commercial laboratory acceptable to the City of Fort Collins. The City reserves the right to perform or witness any of the inspections set forth in this specification where such inspections are deemed necessary. If the cable is not manufactured on the North American continent, the manufacturer shall pay transportation expenses for the City's inspector. In addition to the foregoing, the requirements of AEIC CS8-00, part G, H, and M apply unless otherwise specified.

### 4.2 CLASSIFICATION OF TESTS

The inspection and testing of cable shall be classified as follows:

- a. Qualification tests (core material, thermomechanical, jacket material, CV extrusion, and other ICEA S-94-649-2000 qualification tests).
- b. Functional/Production tests (full reel and sampling electrical and physical tests on completed cable).

#### 4.3 TEST REPORT

The manufacturer shall furnish to the purchaser certified copies of the results of all qualification (core material, thermomechanical, jacket material, CV extrusion, and other ICEA S-94-649-2000 qualification tests), production sampling and completed cable tests on all orders for more than 10,000 feet prior to authorization to ship. Actual test values shall be furnished for all tests including those tests required for engineering information.

The following general information shall be included on all CTR documentation:

- CTR number.
- Plant identification.
- Shipment number.
- Reel count.
- Shipment footage.
- City of Fort Collins Purchase Order Number.
- City of Fort Collins Specification Number.
- Specification number of other applicable specifications including issue date.
- Reference number to track compound quality assurance tests.
- Cable core extruder/CV line identifier.
- Jacket line identifier.
- Cable description and reel number.

In addition, certified copies of test reports shall be furnished for each reel of cable to be shipped and shall contain at least the following information:

- Extrusion (conductor shield, insulation, and insulation shield) dimensions and physical properties.
- Void and contaminant examination results.
- Jacket extrusion dimensions and physical properties.
- Minimum and maximum diameter over insulation, insulation shielding, and jacket.
- Minimum and maximum shield stripping tension
- AC test voltage and time applied.
- Insulation resistance constant and temperature.
- DC resistance of conductors at 25°C.
- A graph of cable stress in volts per mil (or line-to-ground voltage) vs. apparent discharge in picocoulombs.

The above test report shall be certified by an independent testing laboratory unless the City specifically approves manufacturer certification only. A representative of the certifying laboratory shall witness all tests. Reel numbers used in these test reports shall correspond to reel numbers required by paragraph J.3.2 of AEIC No. CS8-00. Reel numbers not corresponding to test report numbers will be rejected and returned at the manufacturer's expense. In the case of duplicates **both** reels will be rejected and returned.

#### 4.4 SIMILARITY OF TESTS

With written concurrence from the City of Fort Collins, partial fulfillment of qualification testing requirements on the basis of similarity of the article to previously qualified articles is permissible, provided the similarity is clearly defined and provided no modifications which could affect the test results or integrity of the article have been made.

Any nonidentical construction and/or materials in the similar article and all differences shall be described in detail. Pictorial and written evidence shall be provided. All similar data shall be submitted in a single report and only directly applicable data shall be included. The test report for the similar article shall also be submitted.

## 4.5 QUALIFICATION AND SAMPLING TESTS

Qualification tests and related requirements are cross-referenced in Table 12. The qualification tests consist of sampling tests on conductor shield, insulation, insulation shield, jacket material, partially completed, and completed cable. The impulse test, cyclic aging test, resistance stability test, accelerated water treeing test, accelerated water absorption test, and thermomechanical qualification test may be run on a qualification basis as defined by ICEA if they conform to ICEA and paragraph 4.4 of this specification. All other qualification tests shall be performed **on each order and on each cable design** included on the order. Sampling and frequency of tests shall be in accordance with paragraph 9.16/Table 9.5 of ICEA S-94-649-2000 unless otherwise specified.

**Table 12 – Fort Collins Qualification Tests (production sampling tests and AEIC tests)**

Test	Classification	Requirement Paragraph	Test Reference		
			This Document	AEIC-CS8	ICEA S-94-649
Examination Of Product	P,Q,F	Section 3	4.7.1		9.6
Conductor Shielding Volume Resistivity	P	3.2.2.2	4.7.3		9.8
Wafer Boil	P	3.2.2.2,3.2.2.5	4.7.4		9.4.12
Shielding Physical & Aging Tests (Conductor & Insulation)	P	3.2.2.2, 3.2.2.5	4.7.5		3.5, 5.4.1.3, 9.4.14
Insulation Physical & Aging Tests	P	3.2.2.3	4.7.6		4.3.1.1, 9.2, 9.4
Physical Test Procedures	P	3.2.2.3	4.7.6.1		9.4.8
Aging Tests	P	3.2.2.3	4.7.6.2		9.4.9
Hot Creep – Insulation	P	3.2.2.3	4.7.6.4		4.3.1.1, 9.4.10
Shrink Back Test – Insulation	P	3.2.2.3	4.7.7.1		4.3.1.4, 9.10
High Voltage Time Test	P, Q	3.2.2.3	4.7.7.2		10.1.3
Impulse Breakdown	Q	3.2.2.3	4.7.7.3		10.1.4
Cyclic Aging	Q	3.2.2.3	4.7.7.4		10.1.5
Accelerated Water Absorption	Q	3.2.2.3	4.7.7.5		10.5.2
Accelerated Water Treeing	Q	3.2.2.3	4.7.7.6	M.2	10.1.6
Thermomechanical Qualification Test	Q	3.2.2.3	4.7.7.7	M.3	10.2
Dissipation Factor	Q	3.2.2.3	4.7.7.8		10.4.2
Amber, Protrusion, Void & Contaminant Determination	P	3.2.2.3	4.7.8	G.1	9.4.13
Internal Irregularity Test	P	3.2.2.3	4.7.9	G.2	
Insulation Shielding Volume Resistivity	P	3.2.2.5	4.7.10	C.5, G.3.7	9.8.2
Insulation Shielding Strippability	P	3.2.2.5	4.7.11	E.3, G.3	9.9
Resistance Stability Test	Q	3.2.2.5	4.7.12		3.6.1, 9.8, 10.5.3
Shrink Back Test – Jacket	P	3.2.2.8	4.7.13		
Heat Distortion – Jacket	P	3.2.2.8	4.7.14		9.7.2

P – production sampling test (includes some tests not identified by AEIC/ICEA as production sampling tests)

Q – AEIC/ICEA qualification test

F – functional test on completed cable (also see table 13)

#### 4.6 FUNCTIONAL TESTS (ELECTRICAL AND PHYSICAL TESTS ON COMPLETED CABLES)

Functional tests shall consist of those tests and related requirements as cross-referenced in Table 13 and shall be performed on shipping length of completed cable.

**Table 13 – Functional Tests**

TEST	Requirement Paragraph	Test Paragraph
Examination of Product	Section 3	4.7.1
Conductor Tests	3.2.2.1	4.7.2
Alternating-Current Voltage	3.2.2.3.1	4.8.1
Insulation Resistance	3.2.2.3.2	4.8.2
Partial Discharge	3.2.2.3.3	4.8.3

#### 4.7 TEST METHODS (QUALIFICATION AND SAMPLING)

##### 4.7.1 Examination of Product

**Each shipping length** of completed cable shall be inspected to determine compliance with respect to freedom from water under the jacket or in the conductor, insulation thickness, conductor diameter and cross-sectional area, dimensions, material, workmanship, construction and marking. **If, when inspecting dimensions, either diameter at either end of a shipping reel is outside the permissible tolerance range, the entire reel shall be rejected.**

##### 4.7.2 Conductor Tests

Conductor resistance of each shipping reel shall be measured and recorded in ohms per 1000 feet at 25°C. Other conductor tests shall be in accordance with ICEA S-94-649-2000, paragraph 9.3.

##### 4.7.3 Conductor Shielding Volume Resistivity

The volume resistivity of the conductor shielding shall be measured and recorded at 25°C, 90°C, 100°C  $\pm 2^\circ\text{C}$  in accordance with paragraph 9.8 of ICEA S-94-649-2000.

##### 4.7.4 Wafer Boil Test (Conductor And Insulation Shielding Solvent Extraction)

Conductor and insulation shielding wafer boil tests shall be in accordance with ICEA S-94-649-2000, paragraph 9.4.12.

##### 4.7.5 Physical and Aging Tests Of Semiconducting Shields

Physical and aging tests shall be performed on the conductor shielding and insulation shielding in accordance with ICEA S-94-649-2000, paragraph 9.4.14.

##### 4.7.6 Insulation Tests (Physical And Aging)

Physical and aging testing shall be in accordance with ICEA S-94-649-2000, paragraphs 9.2 and 9.4 and paragraphs 4.7.6.1 through 4.7.6.4 of this specification.

##### 4.7.6.1 Physical Test Procedures

Tensile strength tests and elongation tests shall be performed in accordance with the applicable procedures of ICEA S-94-649-2000, paragraph 9.4.8.3.

#### 4.7.6.2 Aging Tests

Air oven aging tests shall be performed in accordance with ICEA S-94-649-2000, paragraphs 9.4.9.1 and 9.4.9.2. The test specimens shall be heated at  $121^{\circ}\text{C} \pm 1^{\circ}\text{C}$  for 168 hours.

#### 4.7.6.3 Deleted

#### 4.7.6.4 Hot Creep – Insulation

Hot creep tests shall be in accordance with ICEA S-94-649-2000, paragraph 9.4.10. Hot creep and set requirements shall be determined at  $150^{\circ}\text{C} \pm 2^{\circ}\text{C}$  in accordance with ICEA T-28-562. Elongation and set shall comply with the requirements for unfilled insulation given in table 4.2 of ICEA S-94-649-2000.

#### 4.7.7 Physical and Electrical Tests – Insulated Conductor

Samples of insulated conductor shall be tested in accordance with the following procedures:

##### 4.7.7.1 Insulation Shrink Back Test

Tests to determine shrink back shall be in accordance with ICEA S-94-69 paragraph 9.10.

##### 4.7.7.2 High Voltage Time Test

High voltage time tests (HVTT) shall be performed in accordance with ICEA S94-649-2000, paragraph 10.1.3. In addition to a qualification test, **The HVTT SHALL BE PERFORMED AS A PRODUCTION TEST**. Cable shall be aged in accordance with paragraph 10.1.5.4 of ICEA S94-649-2000 and the first step shall be held for one hour with each successive step held for ½ hour. This test shall be performed on each cable design included on an order. Sampling frequency shall be one test for each 100,000 feet of cable or fraction thereof. A sample that fails to withstand the 620v/mil step shall be considered to have failed.

##### 4.7.7.3 Impulse Breakdown Test

Impulse breakdown tests shall be performed in accordance with ICEA S94-649-2000, paragraph 10.1.4.

##### 4.7.7.4 Cyclic Aging

Cyclic aging tests shall be performed in accordance with ICEA S94-649-2000, 10.1.5.

##### 4.7.7.5 Accelerated Water Absorption Test

The accelerated water absorption test shall be performed in accordance with paragraph 10.5.2 of ICEA S94-649-2000.

##### 4.7.7.6 Accelerated Water Treeing Test

Accelerated water treeing test shall be performed in accordance with paragraph 10.1.6 of ICEA S94-649-2000.

##### 4.7.7.7 Thermomechanical Qualification Test

A thermomechanical qualification test shall be performed in accordance with section M.3 of AEIC CS-00 and paragraph 10.2 of ICEA S94-649-2000.

##### 4.7.7.8 Dissipation Factor Verification Tests

Dissipation factor tests shall be performed in accordance with paragraph 10.4.2 of ICEA S94-649-2000.

#### 4.7.8 Void and Contaminant Determination

Tests for and reporting of voids and contamination shall be in accordance with AEIC No. CS8, paragraph G.1.



#### 4.7.9 Internal Irregularity Test

Internal irregularity tests shall be performed in accordance with AEIC No. CS8, paragraph G.2.

#### 4.7.10 Insulation Shielding Volume Resistivity

Insulation shielding volume resistivity tests shall be performed in accordance with paragraph 9.8.2 of ICEA S94-649-2000. The volume resistivity of the insulation shielding shall be measured at 25°C, 90°C, and 110°C ± 2°C.

#### 4.7.11 Shield Stripping

Insulation shield stripping tests shall be performed in accordance with paragraph 9.9 of ICEA S94-649-2000 and AEIC No. CS8, paragraph G.3. **A minimum of one sample shall be taken from each shipping reel.**

#### 4.7.12 Radial Resistivity Test

Tests for shield resistance stability shall be in accordance with paragraph 10.5.3 of ICEA S94-649-2000.

#### 4.7.13 Jacket Shrinkback Test

A 3-foot sample shall be taken from the first 10,000 feet of production and one sample every 50,000 feet thereafter. Square cut a 1-foot specimen from the center of the 3-foot sample and place in an air oven @ 75 C for 20 hours. Remove sample and allow to cool at room temperature. Measure the shrinkback at each end. The total combined allowable shrinkback shall not exceed 300 mils.

#### 4.7.14 Heat Distortion – Jacket

Heat distortion testing shall be performed in accordance with ICEA T-27-581/NEMA WC-53.

### 4.8 TEST METHODS (FUNCTIONAL TESTS)

**Each shipping reel** of completed cable shall be tested in accordance with paragraph 9.12 of ICEA S-94-649-2000 and/or the following procedures:

#### 4.8.1 Alternating - Current Voltage Test

The dielectric strength of the insulation shall be tested at the applicable voltage given in Table 4 of this specification in accordance with paragraph 9.12.2 of ICEA S-94-649-2000.

#### 4.8.2 Insulation Resistance

The insulation resistance shall be measured after the voltage tests on a minimum of three shipping reels per cable core extruder run. Where the voltage tests are made on wire or cable immersed in water, the insulation resistance shall be measured while the cable is still immersed. The insulation resistance shall be measured and recorded in megohms per 1000 feet in accordance with ICEA T-27-581/NEMA WC-53. A constant of 30,000 shall be used in calculating the minimum insulation resistance. Temperature shall be corrected using a coefficient of 1.03.

#### 4.8.3 Partial Discharge Test

**Each shipping reel** of completed cable shall be tested for compliance with paragraph 3.2.2.3.3 of this specification in accordance with the procedures given in paragraph 9.13 of ICEA S-94-649-2000. The apparent discharge characteristic shall be obtained from an x-y recording.

## 5 PREPARATION FOR DELIVERY

Packaging and marking of the articles procured under this specification shall be in accordance with AEIC No. CS8, section J and the following requirements. Nails used in reels shall be galvanized, resin coated, or self-clenching and set so they cannot work free and damage the cable. All reels shall be inspected for protruding nails and, if required, corrective action taken **before** cable is put on the reel.

- 5.1 Each reel shall be protected with a covering in conformance with NEMA WC-26 Class 2 as approved in writing by Fort Collins Utilities, Electric Department, Engineering Standards. The covering shall be banded in place with a minimum of two 1/2" steel bands. Reels shall be shipped on open-bed truck(s) with reels in the upright position; i.e., on flanges, and blocked to prevent movement during shipping.
- 5.2 Each reel shall be marked with the following information.
  - 5.2.1 Description of the product.
  - 5.2.2 Name of the manufacturer, manufacturing plant location, and lot number as referenced in all test reports.
  - 5.2.3 Tare, gross and net weights.
  - 5.2.4 Total footage as well as the sequential footage marking numbers of each end
  - 5.2.5 Fort Collins Utilities purchase order number and item number
  - 5.2.6 Month and year of manufacture
- 5.3 Reel numbers not corresponding to test report numbers will be rejected and returned at the manufacturer's expense. **In the case of duplicate reel numbers, both reels will be rejected and returned.** The supplier shall also comply with all modifications and additions required in the purchase order and supplemental instructions.

**6 DEF                    D            E**

**°C** - Degree Celsius (Centigrade)

**°F** - Degree Fahrenheit

**AC or a.c.** - Alternating current

**ARTICLE, UNIT, ASSEMBLY**- All refer to the cable defined by this specification

**AWG** - American Wire Gauge

**CPS OR Hz** - Cycles per second

**DC or d.c.** - Direct current

**kcmil** – thousands of circular mils (formerly MCM)

**kV** - 1000 volts

**PSI** - Pounds per square inch

**SHIPPING REEL** – A completed reel of cable cut into the final length to be shipped to the customer

**SIC** - Specified Inductive Capacity (Dielectric Constant)

**TRXLPE** – Tree-Retardant Crosslinked Polyethylene

**V or v** – Volts

**VENDOR OR SUPPLIER** - The manufacturer and/or manufacturer's agent supplying or quoting on the specified article

**XLP** - Cross-linked thermosetting polyethylene

**APPENDIX A**

**Approved Manufactures**

General Cable Corporation  
4 Tesseneer Drive  
Highland Heights, Kentucky 41076-9753

Hendrix Wire and Cable  
c/o Power Equipment Specialists, Inc.  
10200 W. 44<sup>th</sup> Ave. Suite 120  
Wheatridge, CO 80033-2838

Pirelli Cable Corporation  
1470 Will S. Green Avenue  
Colusa, CA 95932

Southwire Company  
455 W. Diamond Drive, Suite 106  
Tempe, AZ 85283

**SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**  
**SPECIFICATION 367-102**

In addition to the requirements of the "Invitation to Bid" and the "Purchase Requisition", the following shall apply:

A. Data to be Supplied With Bidder's Proposal

Current AEIC core material qualification and CV extrusion test reports.

B. Price Quotation

Price shall be firm.

C. Preparation for Delivery

Cable shall be shipped in the lengths specified below on N-R reels meeting the following requirements:

MAX. FLANGE DIA. (IN.)	MAX O/A WIDTH (IN.)	MIN. DRUM DIA. (IN.)	MIN. RIM CLEAR (IN.)	FEET PER REEL
70	37	28	2	1400 ± 25

Negotiated shorts and overages are not acceptable unless specifically allowed on bid sheet.

Each reel shall be 100 percent lagged.

Shipping Terms: F.O.B. point of delivery, freight prepaid and allowed.

Shipment shall be by truck with reels in an upright position; i.e., reels shall not be shipped flat.

D. FAILURE TO MEET QUOTED DELIVERY

If a manufacturer fails to meet quoted delivery that manufacturer may be debarred from consideration for award of contracts for a period not to exceed three years.

E. DATE OF RECEIPT OF ORDER DEFINED

The purchase order will be sent by certified mail, return receipt requested and the date shown on the return receipt shall be considered the date of receipt of order. In special cases, confirming orders may be telephoned to the manufacturer, and the date shown on the purchase order shall be considered the date of receipt of order.

F. DATE OF SHIPMENT DEFINED

The date of shipment shall be defined as the date the bill of lading is signed by **carrier**.