THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 172-2005

SUPPLY AND DELIVERY OF TRAFFIC SIGNAL CABLE

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PART B - BIDDING PROCEDURES

B1. PROJECT TITLE

B1.1 SUPPLY AND DELIVERY OF TRAFFIC SIGNAL CABLE

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 4:00 p.m. Winnipeg time, April 27, 2005.

B2.2 Bid Submissions determined by the Manager of Materials to have been received later than the Submission Deadline will not be accepted and will be returned upon request.

B2.3 The Contract Administrator or the Manager of Materials may extend the Submission Deadline by issuing an addendum at any time prior to the time and date specified in B2.1.

B3. ENQUIRIES

B3.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

B3.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

B3.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B3.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B3.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B3 unless that response or interpretation is provided by the Contract Administrator in writing.

B4. ADDENDA

B4.1 The Contract Administrator may, at any time prior to the Submission deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B4.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B4.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B4.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site for addenda shortly before submitting his Bid.

B4.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 8 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B5. SUBSTITUTES

B5.1 The Work is based on the materials, equipment, methods and products specified in the Bid Opportunity.

B5.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B5.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least seven (7) Business Days prior to the Submission Deadline.

B5.4 The Bidder shall ensure that any and all requests for approval of a substitute:

(a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the material, equipment, method or product as either an approved equal or alternative;

(b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;

(c) identify any anticipated cost or time savings that may be associated with the substitute;

(d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the Contract; and

(e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the Contract.

B5.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an “approved equal” or as an “approved alternative”, or may refuse to grant approval of the substitute.

B5.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B5.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.

B5.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B5.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative shall base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B13.

B5.9 No later claim by the Contractor for an addition to the price(s) because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B6. BID SUBMISSION

B6.1 The Bid Submission consists of the following components:

(a) Form A: Bid; and

(b) Form B: Prices.

B6.2 All components of the Bid Submission shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely in ink, to constitute a responsive Bid.

B6.3 The Bid Submission may be submitted by mail, courier or personal delivery, or by facsimile transmission.

B6.4 If the Bid Submission is submitted by mail, courier or personal delivery, it shall be enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address, and shall be submitted to:

The City of Winnipeg
Corporate Finance Department
Materials Management Branch
185 King Street, Main Floor
Winnipeg, MB R3B 1J1

B6.4.1 Samples or other components of the Bid Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder’s Bid Submission.

B6.5 If the Bid Submission is submitted by facsimile transmission, it shall be submitted to (204) 949-1178.

B6.5.1 The Bidder is advised that the City cannot take responsibility for the availability of the facsimile machine at any time.

B6.6 Bid Submissions submitted by internet electronic mail (e-mail) will not be accepted.

B7. BID

B7.1 The Bidder shall complete Form A: Bid, making all required entries.

B7.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;

(b) if the Bidder is a partnership, the full name of the partnership shall be inserted;

(c) if the Bidder is a corporation, the full name of the corporation shall be inserted; and

(d) if the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

B7.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B7.2.

B7.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B7.4 Paragraph 10 of Form A: Bid shall be signed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his own name, it shall be signed by the Bidder;

(b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;

(c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers; and

(d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

B7.4.1 The name and official capacity of all individuals signing Form A: Bid shall be printed below such signatures.

B7.4.2 All signatures shall be original.

B7.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid Submission and the Contract, when awarded, shall be both joint and several.

B8. PRICES

B8.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B8.1.1 Prices on Form B: Prices shall include:

(a) duty;

(b) freight and cartage;

(c) Provincial and Federal taxes [except the Goods and Services Tax (GST) and Manitoba Retail Sales Tax (MRST, also known as PST), which shall be extra where applicable] and all charges governmental or otherwise paid; and

(d) profit and all compensation which shall be due to the Contractor for the Work and all risks and contingencies connected therewith.

B8.1.2 Prices on Form B: Prices shall not include the Manitoba Association for Resource Recovery Corporation (MARRC) Environmental Handling Charge (EHC) which shall be extra where applicable.

B8.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.

B8.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.

B9. QUALIFICATION

B9.1 The Bidder shall:

(a) undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Bidder does not carry on business in Manitoba, in the jurisdiction where the Bidder does carry on business;

(b) be responsible and not be suspended, debarred or in default of any obligation to the City;

(c) be financially capable of carrying out the terms of the Contract;

(d) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract;

(e) have successfully carried out work, similar in nature, scope and value to the Work;

(f) employ only Subcontractors who:

(i) are responsible and not suspended, debarred or in default of any obligation to the City (a list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt); and

(ii) have successfully carried out work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of performing the Work required to be done in accordance with the terms of the Contract.

(g) have a written workplace safety and health program in accordance with The Workplace Safety and Health Act (Manitoba).

B9.2 The Bidder shall be prepared to submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B9.3 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B10. OPENING OF BIDS AND RELEASE OF INFORMATION

B10.1 Bid Submissions will not be opened publicly.

B10.2 Within two (2) Business Days following the Submission Deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B10.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract Amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B10.4 The Bidder is advised that any information contained in any Bid Submission may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B11. IRREVOCABLE BID

B11.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 9 of Form A: Bid.

B11.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work for the time period specified in Paragraph 9 of Form A: Bid.

B12. WITHDRAWAL OF BIDS

B12.1 A Bidder may withdraw his Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B12.1.1 Notwithstanding GC.7.05(2), the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B12.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 10 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B12.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials shall:

(a) retain the Bid Submission until after the Submission Deadline has elapsed;

(b) open the Bid Submission to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 10 of Form A: Bid; and

(c) if the notice has been given by any one of the persons specified in B12.1.3(b), declare the Bid withdrawn.

B12.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B11.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law.

B13. EVALUATION OF BIDS

B13.1 Award of the Contract shall be based on the following bid evaluation criteria:

(a) compliance by the Bidder with the requirements of the Bid Opportunity (pass/fail);

(b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B9 (pass/fail);

(c) Total Bid Price; and

(d) economic analysis of any approved alternative pursuant to B5.

B13.2 Further to B13.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid Submission is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements if the interests of the City so require.

B13.3 Further to B13.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid Submission or in other information required to be submitted, that he is responsible and qualified.

B13.4 Further to B13.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.

B13.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.

B13.4.2 This Contract will be awarded as a whole.

B14. AWARD OF CONTRACT

B14.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B14.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

B14.2.1 Without limiting the generality of B14.2, the City will have no obligation to award a Contract where:

(a) the prices exceed the available City funds for the Work;

(b) the prices are materially in excess of the prices received for similar work in the past;

(c) the prices are materially in excess of the City's cost to perform the Work, or a significant portion thereof, with its own forces;

(d) only one Bid is received; or

(e) in the judgment of the Award Authority, the interests of the City would best be served by not awarding a Contract.

B14.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid.

B14.4 Notwithstanding GC.3.01 and GC.3.02, the City will issue a purchase order to the successful Bidder in lieu of the execution of a Contract.

B14.5 The Contract Documents, as defined in GC.1.01(7), in their entirety shall be deemed to be incorporated in and to form a part of the purchase order notwithstanding that they are not necessarily attached to or accompany said purchase order.

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

C1.1 The *General Conditions for the Supply and Delivery of Goods* (Form 21: 88 03) are applicable to the Work of the Contract.

C1.1.1 The *General Conditions for the Supply and Delivery of Goods* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

D1.1 In addition to the *General Conditions for the Supply and Delivery of Goods*, these Supplemental Conditions are applicable to the Work of the Contract.

D1.2 The General Conditions are amended by striking out “The City of Winnipeg Act” wherever it appears in the General Conditions and substituting “The City of Winnipeg Charter”.

D1.3 The General Conditions are amended by striking out “Board of Commissioners” or “Commissioner” wherever it appears in the General Conditions and substituting the “Chief Administrative Officer”.

D1.4 The General Conditions are amended by striking out “Tender Package” wherever it appears in the General Conditions and substituting “Bid Opportunity”.

D1.5 The General Conditions are amended by striking out “Tender Submission” wherever it appears in the General Conditions and substituting “Bid Submission”.

D1.6 The General Conditions are amended by striking out “Bidding Instructions” wherever it appears in the General Conditions and substituting “Bidding Procedures”.

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of the Supply and Delivery of Traffic Signal Cable for the period of June 01, 2005 to May 31, 2008.

D2.2 The Work shall be done on an "as required" basis during the term of the Contract.

D2.2.1 The type and quantity of Work to be performed under this Contract shall be as authorized from time to time by the Contract Administrator and/or Users.

D2.3 The following Drawings are applicable to the Work:

Drawing No.	Drawing Name/Title
ST – 127-R1	Specifications for Traffic Signal Cable Geometry for 22 and 38 Conductor Cables

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

(a) “**Business Day**" means any Calendar Day, other than a Saturday, Sunday, or a Statutory or Civic Holiday;

(b) “**Submission Deadline**” and “**Time and Date Set for the Final Receipt of Bids**” mean the time and date set out in the Bidding Procedures for final receipt of Bids;

(c) "**User**" means a person, department or other administrative unit of the City authorized by the Contract Administrator to order Work under this Contract.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is:

Mr. Bill Woroby, P. Eng.
Staff Engineer
103 – 1155 Pacific Avenue
Winnipeg, Manitoba R3E 3P1

Telephone No.: (204) 986-5326
Facsimile No.: (204) 986-7358

D5. NOTICES

D5.1 GC.7.05 is hereby amended to delete reference to "registered mail" and to replace same with "ordinary mail".

D5.2 GC.7.05 is further amended hereby to include delivery by facsimile transmission (fax) as an acceptable means of delivering notices, consents, approvals, statements, authorizations, documents or other communications required or permitted to be given under this Contract. Deliveries by fax will be deemed to have been received on the day of delivery, if a business day, or if not a business day, on the business day next following the day of delivery.

D5.3 Further to GC.7.05, all notices, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D5.4, D5.5 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.

D5.4 All notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following address or facsimile number:

The City of Winnipeg
Chief Administrative Officer Secretariat
Administration Building, 3rd Floor
510 Main Street
Winnipeg, MB R3B 1B9

Facsimile No.: (204) 949-1174

D5.5 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

The City of Winnipeg
Corporate Services Department
Legal Services Division
185 King Street, 3rd Floor
Winnipeg, MB R3B 1J1

Facsimile No.: (204) 947-9155

SUBMISSIONS

D6. AUTHORITY TO CARRY ON BUSINESS

D6.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

CONTROL OF WORK

D7. COMMENCEMENT

D7.1 The Contractor shall not commence any Work until he is in receipt of a purchase order authorizing the commencement of the Work.

D8. ORDERS

D8.1 The Contractor shall provide a local Winnipeg telephone number or a toll-free telephone number at which orders for delivery may be placed.

D9. DELIVERY

D9.1 Goods shall be delivered on a “when required” basis during the term of the Contract, f.o.b. destination, freight prepaid, to:

Equipment and Material Stores
1277 Pacific Avenue
Winnipeg, MB

D9.2 Goods shall be delivered within sixty (60) Business Days of the placing of an order, except where otherwise agreed at the time of ordering.

D9.3 Goods shall be delivered between 7:30 a.m. and 3:00 p.m. on Business Days.

D9.4 The Contractor shall off-load goods as directed at the delivery location.

D10. RECORDS

D10.1 The Contractor shall keep detailed records of the goods supplied under the Contract.

D10.2 The Contractor shall record, as a minimum, for each item listed on Form B: Prices:

(a) User name(s) and addresses;

(b) order date(s);

(c) delivery date(s); and

(d) description and quantity of goods supplied.

D10.3 The Contractor shall provide the Contract Administrator with a copy of the records for each year within thirty (30) Calendar Days of the end of that year.

MEASUREMENT AND PAYMENT

D11. INVOICES

D11.1 Further to GC.9.01 and notwithstanding GC.9.03, the Contractor shall submit an invoice for each order delivered.

D11.1.1 Further to D5.3, the Contractor shall submit invoices to the locations designated at the time of ordering.

D11.2 Invoices must clearly indicate, as a minimum:

(a) the City's order number;

(b) date of delivery;

(c) delivery address;

(d) type and quantity of goods delivered;

(e) the amount payable with GST and MRST shown as separate amounts; and

(f) the Contractor's GST registration number.

D11.3 The City will bear no responsibility for delays in approval of invoices which are improperly submitted.

D12. PAYMENT

D12.1 Further to GC.9.01 and GC.9.03, payment shall be in Canadian funds net thirty (30) Calendar Days after receipt and approval of the Contractor's invoice.

D13. REEL DEPOSIT

D13.1 The Contractor shall include, if applicable, reel deposit charges on Form B: Prices, if this item is not completed it will be understood that there are no reel deposit charges apply.

D13.2 The Contractor shall pay all transportation charges both ways on all items in accordance with D9.1. The items will be used by the City of Winnipeg when the reel is emptied, the Contract Administrator will inform the Contractor’s for the return instruction.

D13.3 The

D14. IDENTIFICATION

D14.1 Each shipping length of cable shall be indelibly marked to show the remaining length of cable, in metres, on the outer surface of the cable jacket, one mark per metre. The readily legible “length remaining” digits shall be applied at one metre intervals on the outer jacket surface by means of “indent printing” or alternatively in indelible white or light coloured contrasting ink which cannot be rubbed off or washed off.

D14.2 In most cases, each shipping length of cable will bear a “zero” mark at the inner end of the cable on the reel, with incrementing metre mark values throughout the length of the cable. Exceptions may be permitted to allow “non-zero” markings at the inner end of the reel, should defective sections of cable have to be removed as a consequence of failing the voltage rating tests on the finished cable.

D14.3 The cable jacket shall also bear the legend “**WPG YYMM**” (YY = Year and MM = Month of manufacture) in legible characters, applied to the outer surface of the cable jacket by means of indent printing or indelible white or light coloured contrasting ink, which cannot be rubbed off or washed off. This legend shall also include the **voltage rating** of the cable, and shall be applied in one metre intervals along the entire length of cable.

D15. PACKING AND MARKING FOR SHIPMENT

D15.1 Reels shall be substantially constructed and in good condition with drum diameters sufficient to prevent damage to the cables shipped on it. Reels shall have a maximum diameter of 54 inches and minimum diameter of 48 inches.

D15.2 The width of each reel shall be 30 inches minimum and 34-inches maximum.

D15.3 The cables shall be suitably protected. Each end of the cable shall be available for testing and visual inspection of the metre markings, and shall be properly sealed and protected against injury. The innermost cable end (normally bearing the “zero” mark, shall protrude no more than 0.5 metre through the side of the reel.

D15.4 Reels shall be capable of being supported by a two (2) inch diameter shaft inserted in holes centred within the circular reel flanges. Steel arbour hole plates shall be provided on all reels.

D15.5 Each reel shall be plainly and permanently marked **on a metal tag** with the manufacturer’s full description of the cable, giving the type and length of the cable on the reel, the number and size of the conductors in the cable and the voltage rating.

D15.6 Each reel shall bear a unique reel number.

D15.7 Each reel shall contain a continuous length of cable filled to within two (2) inches of the outer edge of the reel, excepting the last reel, which may be under filled to complete the order.

D16. SAMPLING, INSPECTION AND ACCEPTANCE

D16.1 Inspection and tests shall be made prior to shipment and at the place of manufacture.

D16.2 The manufacturer shall furnish the City’s Contract Administrator in suitable form a certified report of the tests made on the cable to show compliance with this specification. No payment for any cable supplied shall be made until a satisfactory test report has been furnished to and accepted by the City.

D16.3 The manufacturer shall be required to supply the City’s Contract Administrator, in advance of the delivery of the required quantity of cable, a sample of the finished and tested cable, the sample being at least one (1) metre in length, containing at least two (2) sequential metre markings.

D16.4 Tests on Finished Individual Conductors – Each finished conductor shall meet the spark test requirement of Paragraph E4.4, E13.4, E23.4, E33.4 and E45.4 (7,500 volt) as soon as possible prior to cabling. All spark test failures shall be repaired before cabling.

D16.5 Tests on Finished Cable – Each conductor shall be tested against other conductors. The individual conductors of each length of completed cable shall withstand without break down (1) the application for one minute of a 60 Hertz, 2,500 volt essentially sinusoidal test potential (RMS) in accordance with the method and using equipment specified in Underwriters Laboratories, Inc. Standard UL 83 (ANSI C33.8) or (2) a DC test which shall be a short duration (5 second minimum) application of a DC voltage of ten times the Voltage Rating of the cable.

WARRANTY

D17. WARRANTY

D17.1 Notwithstanding GC.10.01 and GC.10.02, the warranty period for each item of Work supplied shall begin on the date of successful delivery and shall expire one (1) year thereafter unless extended pursuant to D17.2, in which case it shall expire when provided for thereunder.

D17.2 If a defect or deficiency prevents the full and normal use or operation of the Work or any portion thereof, for purposes of calculating the warranty period, time shall be deemed to cease to elapse for the defective or deficient portion, and for any portion of the Work whose use or operation is prevented by such defect or deficiency, as of the date on which the defect or deficiency is observed or the use or operation is prevented and shall begin to run again when

the defect or deficiency has been corrected or the Work may be used or operated to the satisfaction of the Contract Administrator.

D17.3 Notwithstanding GC.10.01, GC.10.02 and D17.2, if any law of Manitoba or of the jurisdiction in which the Work was manufactured requires, or if the manufacturer provides, a longer warranty period or a warranty which is more extensive in its nature, then the provisions of such law or manufacturer's warranty shall apply.

PART E - SPECIFICATIONS

THREE (3) CONDUCTOR #8AWG POLYETHYLENE INSULATED, WITH #8 AWG BARE CONDUCTOR, POLYETHYLENE JACKETED TRAFFIC SIGNAL SERVICE CABLE

E1. SCOPE

E1.1 This specification covers three (3) conductor #8 AWG [American Wire Gauge] polyethylene insulated, with a bare #8 copper grounding wire, polyethylene jacketed traffic signal service cable, rated 600 volts, for use in underground conduit or as aerial cable supported by a messenger as traffic signal power service cable.

E2. GENERAL CONSTRUCTION

E2.1 Cable under this specification shall be composed of stranded copper conductors individually insulated with heat-stabilized polyethylene. The insulated conductors shall be laid up in a compact cable form and bound with suitable moisture-resistant tape. The cable core shall be enclosed in a tight fitting polyethylene compound jacket.

E3. CONDUCTORS

E3.1 The conductors shall be copper and shall, before insulating, conform to the requirements of ASTM [American Society for Testing and Materials] Designation B-3, latest revision.

E3.2 The conductors shall be stranded.

E3.3 The stranded conductors may be either concentric or bunch stranding and shall conform to the circular mil area and physical requirements specified in ASTM Designation B-8, latest revision, for concentric stranding or ASTM Designation B-174, latest revision, for bunch stranding.

E3.4 The three (3) insulated conductors shall be # 8AWG and the bare copper conductor will also be #8AWG.

E4. INSULATION

E4.1 The insulating compound shall be polyethylene.

E4.2 The insulation shall be applied concentrically about the conductor. The minimum acceptable average thickness of the insulation shall be not less than 30 mils (0.762 mm). The minimum acceptable thickness at any point shall be 27 mils (0.686 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI [American National Standards Institute] C33.1).

E4.3 The insulation after application to the conductors shall comply with the requirements specified for Class 30 Thermoplastic Polyethylene compound in Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1), except that the temperature for the cold bend test shall be minus 55.0 ± 2.0° C (minus 67.0 ± 3.6° F).

E4.4 The insulation of the finished conductors before cabling shall withstand without break down the application of a 60 or 3,000 Hertz, 7,500 volt essentially sinusoidal spark test potential (RMS) in accordance with the method and using equipment specified in Underwriters Laboratories, Inc. Standard UL 83 (ANSI C33.8).

E5. CONDUCTOR COLOUR CODING

E5.1 Standard colour coding for cables shall be in accordance with Table 5.1. Base colours shall be obtained by the use of coloured insulation.

TABLE 5.1 -Conductor Colours and Sequence for 3C-#8 AWG Cable

Conductor No.	Wire Colour	Tracer Colour
1	Black	None
2	White	None
3	Red	None
4	"Bare Copper"	n/a

E6. CONDUCTOR ASSEMBLY

E6.1 Multi-Conductor Cables having more than two conductors:

(a) In multi-conductor cables having more than two conductors, the single conductors shall be laid up symmetrically with lay not more than 35 times the insulated conductor diameter.

(b) The outer layer shall be left hand lay.

(c) Fillers shall be used when necessary to secure a uniform assembly of conductors or a firm, compact cylindrical core.

E7. FILLERS

E7.1 Fillers shall be used when necessary to ensure a firm compact cylindrical core. The core shall be fabricated so as to ensure the smallest possible core diameter. Fillers, when used, shall be of a non-metallic, moisture-resistant, non-wicking material which shall have no injurious effect upon other component parts of the cable. The filler shall not wick when tested as follows: One inch (25.4 mm) of the jacket shall be removed from one end of a one foot (30.48 cm) length of cable. This end shall be vertically supported in a two inch (50.8 mm) deep dye (Gentian Violet or equivalent) and water solution for 24 hours. The dye shall not have visibly coloured the top end of the cable.

E8. CABLE TAPE

E8.1 The conductor assembly shall be covered with a wrapping of a moisture-resistant tape applied so as to lap at least 10 percent of its width.

E9. JACKET

E9.1 The taped conductor assembly shall be covered with a tight fitting black thermoplastic polyethylene compound jacket suitable for exposure to sunlight, atmospheric temperatures and stresses reasonably expected in normal installations.

E9.2 The jacket shall be applied tightly over the core assembly and it shall be smooth, free from holes, splits, blisters and other imperfections. The jacket material shall meet the requirements of Table 9.2.

TABLE 9.2 Physical Properties of Polyethylene Jacket

Property	Test Method	Requirements
Tensile strength	**ASTM D2633, Latest Rev.**	**1,700 Psi Min. (11.72 Mpa Min.)**
Elongation	**ASTM D2633, Latest Rev.**	**400% Min.**
Cold Bend	**ASTM D2633 at –55.0 ± 1.0°C**	**No Cracks**
Environmental Cracking	**ASTM D1693, Latest Rev.**	**No Cracks**
Absorption Coefficient	**ASTM D3349, Latest Rev.**	**3,200***

*** Certification of Compliance with this requirement issued by the manufacturer of the polyethylene compound shall suffice in lieu of testing of the finished cable jacket.**

E9.3 The thickness of the jacket shall be UNIFORM at all points along the circumference and shall be 60 Mils (1.524 mm) minimum average acceptable thickness, with a minimum acceptable thickness at any point of 48 Mils (1.219 mm) and maximum acceptable thickness of 72 Mils (1.829 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1).

E9.4 The exterior surface of the jacket shall be smooth, free of wrinkles, grooves and undulations.

E9.5 The jacket shall be durable and tough, yet flexible and capable of readily being skinned.

SEVEN (7) CONDUCTOR POLYETHYLENE INSULATED, POLYETHYLENE JACKETED TRAFFIC SIGNAL CABLE

E10. SCOPE

E10.1 This specification covers seven (7) conductor polyethylene insulated, polyethylene jacketed traffic signal cable, rated 600 volts, for use in underground conduit or as aerial cable supported by a messenger as traffic signal cable.

E11. GENERAL CONSTRUCTION

E11.1 Cable under this specification shall be composed of copper conductors individually insulated with heat-stabilized polyethylene. The insulated conductors shall be laid up in a compact cable form and bound with suitable moisture-resistant tape. Over top of the moisture-resistant tape, shall be installed a single continuous length of cord (the “ripcord”). The cable core, moisture-resistant tape,

E12. CONDUCTORS

E12.1 The conductors shall be copper and shall, before insulating, conform to the requirements of ASTM [American Society for Testing and Materials] Designation B-3, latest revision.

E12.2 The conductors shall be solid.

E12.3 Seven (7) conductors shall be supplied, each conductor # 14AWG [American Wire Gauge].

E13. INSULATION

E13.1 The insulating compound shall be polyethylene.

E13.2 The insulation shall be applied concentrically about the conductor. The minimum acceptable average thickness of the insulation shall be not less than 25 mils (0.635 mm). The minimum acceptable thickness at any point shall be 22 mils (0.569 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI [American National Standards Institute] C33.1).

E13.3 The insulation after application to the conductors shall comply with the requirements specified for Class 30 Thermoplastic Polyethylene compound in Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1), except that the temperature for the cold bend test shall be minus 55.0 ± 2.0° C (minus 67.0 ± 3.6° F).

E13.4 The insulation of the finished conductors before cabling shall withstand without break down the application of a 60 or 3,000 Hertz, 7,500 volt essentially sinusoidal spark test potential (RMS) in accordance with the method and using equipment specified in Underwriters Laboratories, Inc. Standard UL 83 (ANSI C33.8).

E14. CONDUCTOR COLOUR CODING

E14.1 Standard colour coding for cables shall be in accordance with the City of Winnipeg Traffic Signals Colour Code Table 14.1. Base colours shall be obtained by the use of coloured insulation.

TABLE 14.1 City of Winnipeg Traffic Signals Colour Code Conductor Colour and Sequence for Seven (7) Conductor Cables

[Varies from IMSA Specification 20-1 (1991), Table 14.1]

Conductor Number		Base Colour
1	14 ga. solid	Black
2	14 ga. solid	White
3	14 ga. solid	Red
4	14 ga. solid	Green
5	14 ga. solid	Orange
6	14 ga. solid	Blue
7	14 ga. solid	Light Brown

NOTE: Lower conductor numbers represent the inner most conductors in the core.

E15. CONDUCTOR ASSEMBLY

E15.1 Multi-Conductor Cables having more than two conductors:

(a) In multi-conductor cables having more than two conductors, the single conductors shall be laid up symmetrically in layers with lay not more than 15 times the assembled core diameter.

(b) The outer layer shall be left hand lay.

(c) Fillers shall be used when necessary to secure a uniform assembly of conductors or a firm, compact cylindrical core.

E16. FILLERS

E16.1 Fillers shall be used when necessary to ensure a firm compact cylindrical core. The core shall be fabricated so as to ensure the smallest possible core diameter. Fillers, when used, shall be of a non-metallic, moisture-resistant, non-wicking material which shall have no injurious effect upon other component parts of the cable. The filler shall not wick when tested as follows: One inch (25.4 mm) of the jacket shall be removed from one end of a one foot (30.48 cm) length of cable. This end shall be vertically supported in a two inch (50.8 mm) deep dye (Gentian Violet or equivalent) and water solution for 24 hours. The dye shall not have visibly coloured the top end of the cable.

E17. CABLE TAPE

E17.1 The conductor assembly shall be covered with a wrapping of a moisture-resistant tape applied so as to lap at least 10 percent of its width.

E18. RIPCORD

E18.1 Overtop of the moisture-resistant taped conductor assembly shall be supplied a continuous length of nylon or polyester cord, known as the “ripcord”. The ripcord shall be laid longitudinally along the entire length of the taped core assembly, immediately underneath the jacket material. The ripcord may be moulded into the inner surface of the outer jacket material. The ripcord shall be constructed of either one or two strands, the total diameter of which shall be no larger than 20 mils (0.508 mm), and sufficiently strong to sever the jacket material without breaking. The purpose of the ripcord is to assist to skin and remove the jacket material.

E19. JACKET

E19.1 The taped conductor assembly shall be covered with a tight fitting black thermoplastic polyethylene compound jacket suitable for exposure to sunlight, atmospheric temperatures and stresses reasonably expected in normal installations.

E19.2 The jacket shall be applied tightly over the core assembly and it shall be smooth, free from holes, splits, blisters and other imperfections. The jacket material shall meet the requirements of Table 19.2.

TABLE 19.2 –Physical Properties of Polyethylene Jacket

Property	Test Method	Requirements
Tensile strength	**ASTM D2633, Latest Rev.**	**1,700 Psi Min. (11.72 Mpa Min.)**
Elongation	**ASTM D2633, Latest Rev.**	**400% Min.**
Cold Bend	**ASTM D2633 at –55.0 ± 1.0°C**	**No Cracks**
Environmental Cracking	**ASTM D1693, Latest Rev.**	**No Cracks**
Absorption Coefficient	**ASTM D3349, Latest Rev.**	**3,200***

*** Certification of Compliance with this requirement issued by the manufacturer of the polyethylene compound shall suffice in lieu of testing of the finished cable jacket.**

E19.3 The thickness of the jacket shall be UNIFORM at all points along the circumference and shall be 45 Mils (1.143 mm) minimum average acceptable thickness, with a minimum acceptable thickness at any point of 36 Mils (0.914 mm) and maximum acceptable thickness of 54 Mils (1.372 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1).

E19.4 The exterior surface of the jacket shall be smooth, free of wrinkles, grooves and undulations.

E19.5 The jacket shall be durable and tough, yet flexible and capable of readily being skinned by means of the ripcord.

TWENTY-TWO (22) CONDUCTOR POLYETHYLENE INSULATED, POLYETHYLENE JACKETED TRAFFIC SIGNAL CABLE

E20. SCOPE

E20.1 This specification covers twenty-two (22) conductor polyethylene insulated, polyethylene jacketed traffic signal cable, rated 600 volts, for use in underground conduit or as aerial cable supported by a messenger as traffic signal cable.

E21. GENERAL CONSTRUCTION

E21.1 Cable under this specification shall be composed of twenty (20) solid and two (2) stranded copper conductors individually insulated with heat-stabilized polyethylene. The insulated conductors shall be laid up in a compact cable form and bound with suitable moisture-resistant tape. Over top of the moisture-resistant tape, shall be installed a single continuous length of cord (the "ripcord"). The cable core, moisture-resistant tape, and ripcord shall be completely enclosed in a tight fitting polyethylene compound jacket.

E22. CONDUCTORS

E22.1 The conductors shall be copper and shall, before insulating, conform to the requirements of ASTM [American Society for Testing and Materials] Designation B-3, latest revision.

E22.2 Twenty (20) conductors shall be supplied, each conductor # 14 AWG [American Wire Gauge] **solid**.

E22.3 The remaining Two (2) conductors shall be supplied, each # 10 AWG **stranded**.

E22.4 The Two (2) stranded conductors may be either concentric or bunch stranding and shall conform to the circular mil area and physical requirements specified in ASTM Designation B-8, latest revision, for concentric stranding or ASTM Designation B-174, latest revision, for bunch stranding.

E23. INSULATION

E23.1 The insulating compounds shall be polyethylene.

E23.2 The insulation shall be applied concentrically about the conductor. The minimum acceptable average thickness of the insulation shall be not less than 25 mils (0.635 mm) for the 14 gauge and 30 mils (0.762 mm) for the 10 gauge. The minimum acceptable thickness at any point shall be 22 mils (0.569 mm) for the 14 gauge and 27 mils (0.686 mm) for the 10 gauge. The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI [American National Standards Institute] C33.1).

E23.3 The insulation after application to the conductors shall comply with the requirements specified for Class 30 Thermoplastic Polyethylene compound in Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1), except that the temperature for the cold bend test shall be minus 55.0 ± 2.0° C (minus 67.0 ± 3.6° F).

E23.4 The insulation of the finished conductors before cabling shall withstand without break down the application of a 60 or 3,000 Hertz, 7,500 volt essentially sinusoidal spark test potential (RMS) in accordance with the method and using equipment specified in Underwriters Laboratories, Inc. Standard UL 83 (ANSI C33.8).

E24. CONDUCTOR COLOUR CODING

E24.1 Colour coding for cables shall be in accordance with The City of Winnipeg Traffic Signals Colour Code Table 5.1. Base colours shall be obtained by the use of coloured insulation. Tracers shall be extruded coloured stripes which shall be an integral part of the insulation, formed in such a manner as to afford distinctive circuit coding throughout the length of each wire. Tracers shall be continuous, and shall form a continuous longitudinal or spiral line.

TABLE 24.1 City of Winnipeg Traffic Signals
Colour Code Conductor Colour and Sequence
for 22 Conductor Cables
[Varies from IMSA Specification 20-1 (1991), Table 24.1]

Conductor Number		Base Colour	Tracer Colour
1	10 ga. Stranded	Green	-
2	10 ga. Stranded	White	-
3	14 ga. Solid	Red	-
4	14 ga. Solid	Red	Orange
5	14 ga. Solid	Red	Green
6	14 ga. Solid	Orange	Red
7	14 ga. Solid	Orange	-
8	14 ga. Solid	Orange	Green
9	14 ga. Solid	Light Brown	Red
10	14 ga. Solid	Light Brown	Orange
11	14 ga. Solid	Light Brown	Green
12	14 ga. Solid	Blue	Red
13	14 ga. Solid	Blue	Orange
14	14 ga. Solid	Blue	Green
15	14 ga. Solid	Black	-
16	14 ga. Solid	Black	White
17	14 ga. Solid	Yellow	-
18	14 ga. Solid	Yellow	White
19	14 ga. Solid	Violet	-
20	14 ga. Solid	Violet	White
21	14 ga. Solid	Slate	-
22	14 ga. Solid	Slate	White

NOTE: Lower conductor numbers represent the inner most conductors in the core.

E25. CONDUCTOR ASSEMBLY

E25.1 Multi-Conductor Cables having more than two conductors:

(a) In multi-conductor cables having more than two conductors, the single conductors shall be laid up symmetrically in layers with lay not more than 15 times the assembled core diameter.

(b) The outer layer shall be left hand lay.

(c) Fillers shall be used when necessary to secure a uniform assembly of conductors or a firm, compact cylindrical core.

(d) The layout of the conductors will be as specified in Drawing ST-127 (latest revision) for the twenty-two conductor configuration.

E26. FILLERS

E26.1 Fillers shall be used when necessary to ensure a firm compact cylindrical core. The core shall be fabricated so as to ensure the smallest possible core diameter. Fillers, when used, shall be of a non-metallic, moisture-resistant, non-wicking material which shall have no injurious effect upon

other component parts of the cable. The filler shall not wick when tested as follows: One inch (25.4 mm) of the jacket shall be removed from one end of a one foot (30.48 cm) length of cable. This end shall be vertically supported in a two inch (50.8 mm) deep dye (Gentian Violet or equivalent) and water solution for 24 hours. The dye shall not have visibly coloured the top end of the cable.

E27. CABLE TAPE

E27.1 The conductor assembly shall be covered with a wrapping of a moisture-resistant tape applied so as to lap at least 10 percent of its width.

E28. RIPCORD

E28.1 Overtop of the moisture-resistant taped conductor assembly shall be supplied a continuous length of nylon or polyester cord, known as the “ripcord”. The ripcord shall be laid longitudinally along the entire length of the taped core assembly, immediately underneath the jacket material. The ripcord may be moulded into the inner surface of the outer jacket material. The ripcord shall be constructed of either one or two strands, the total diameter of which shall be no larger than 20 mils (0.508 mm), and sufficiently strong to sever the jacket material without breaking. The purpose of the ripcord is to assist to skin and remove the jacket material.

E29. JACKET

E29.1 The taped conductor assembly shall be covered with a tight fitting black thermoplastic polyethylene compound jacket suitable for exposure to sunlight, atmospheric temperatures and stresses reasonably expected in normal installations.

E29.2 The jacket shall be applied tightly over the core assembly and ripcord and it shall be smooth, free from holes, splits, blisters and other imperfections. The jacket material shall meet the requirements of Table 29.2.

TABLE 29.2 Physical Properties of Polyethylene Jacket

Property	Test Method	Requirements
Tensile strength	**ASTM D2633, Latest Rev.**	**1,700 Psi Min. (11.72 Mpa Min.)**
Elongation	**ASTM D2633, Latest Rev.**	**400% Min.**
Cold Bend	**ASTM D2633 at –55.0 ± 1.0°C**	**No Cracks**
Environmental Cracking	**ASTM D1693, Latest Rev.**	**No Cracks**
Absorption Coefficient	**ASTM D3349, Latest Rev.**	**3,200***

*** Certification of Compliance with this requirement issued by the manufacturer of the polyethylene compound shall suffice in lieu of testing of the finished cable jacket**.

E29.3 The thickness of the jacket shall be UNIFORM at all points along the circumference and along the full length of the cable, thus having a tubular cross-section. The thickness of the jacket shall be 54 Mils (1.372 mm) minimum average acceptable thickness, with a minimum acceptable thickness at any point of 48 Mils (1.219 mm) and maximum acceptable thickness of 60 Mils (1.524 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1).

E29.4 The exterior surface of the jacket shall be smooth, free of wrinkles, grooves and undulations.

E29.5 The jacket shall be durable and tough, yet flexible and capable of readily being skinned by means of the ripcord.

SIX (6) PAIR #19AWG POLYETHYLENE INSULATED, POLYETHYLENE JACKETED TRAFFIC SIGNAL CABLE WITH COPPER SHIELD AND RIPCORD

E30. SCOPE

E30.1 This specification covers six (6) pair polyethylene insulated, polyethylene jacketed traffic signal cable with (copper) electrical shielding and ripcord, rated 300 volts, for use in underground conduit or as aerial cable supported by a messenger, as traffic communications and data acquisition cable suitable for limited power use.

E31. GENERAL CONSTRUCTION

E31.1 Cable under this specification shall be composed of uncoated copper conductors individually insulated with heat-stabilized polyethylene. The insulated conductors shall be twisted into pairs and laid up in a compact form and bound with suitable moisture-resistant tape. The cable core and moisture-resistant tape, shall be completely wrapped in an electrically continuous (copper) metallic shield over top of which shall be installed a single continuous length of cord (the “ripcord”). The cable core, moisture resistant tape, copper shield and ripcord shall be completely enclosed in a polyethylene compound jacket.

E32. CONDUCTORS

E32.1 The conductors shall be copper and shall, before insulating, conform to the requirements of ASTM [American Society for Testing and Materials] Designation B-3, latest revision.

E32.2 The conductors shall be solid and uncoated.

E32.3 Twelve (12) individual conductors shall be supplied, each conductor # 19AWG [American Wire Gauge] and twisted to form six (6) individual conductor pairs.

E33. INSULATION

E33.1 The insulating compound shall be polyethylene.

E33.2 The insulation shall be applied concentrically about the conductor. The minimum acceptable average thickness of the insulation shall be not less than 15 mils (0.38 mm). The minimum acceptable thickness at any point shall be 13 mils (0.33 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI [American National Standards Institute] C33.1).

E33.3 The insulation after application to the conductors shall comply with the requirements specified for Class 30 Thermoplastic Polyethylene compound in Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1), except that the temperature for the cold bend test shall be minus 55.0 ± 2.0° C.

E33.4 The insulation of the finished conductors before cabling shall withstand without break down the application of a 60 or 3,000 Hertz, 4,000 volt essentially sinusoidal spark test potential (RMS) in accordance with the method and using equipment specified in Underwriters Laboratories, Inc. Standard UL 83 (ANSI C33.8).

E34. IDENTIFICATION OF PAIRS

E34.1 The polyethylene compound used for conductor insulation shall be coloured, so as to identify (1) the “wire” and “mate” conductor for each pair and (2) each pair in the completed cable.

E34.2 Base colours shall be obtained by the use of coloured polyethylene insulating compound. "Tracers" shall be extruded white stripes which shall be an integral part of the insulation, formed in such a manner as to afford distinctive circuit colour coding throughout the length of each "mate" conductor. The white tracer shall form a continuous longitudinal or spiral line throughout the length of the "mate" conductor.

E34.3 The colours of each "wire" and "mate" conductor of each pair, together with the pair numbers shall be in accordance with City of Winnipeg Traffic Signals Colour Code defined by Table 34.3.

TABLE 34.3 Conductor Colour and Sequence for Cables
[Varies from IMSA Specification 40-2 (1991), TABLE 46.3]

Pair No.	Wire Colour	Mate Colour
1	**Blue**	**Blue with White Tracer**
2	**Orange**	**Orange with White Tracer**
3	**Green**	**Green with White Tracer**
4	**Brown**	**Brown with White Tracer**
5	**Slate**	**Slate with White Tracer**
6	**Red**	**Red with White Tracer**

E35. TWISTING

E35.1 The insulated conductors shall be twisted into pairs.

E35.2 Lengths of lay of pairs shall be staggered so, that pairs having the same length of lay shall be separated by at least two pairs having different lengths of lay.

E35.3 To help ascertain pair identity of the two wires comprising a pair, the maximum length of lay of pairs twisted shall not exceed six (6) inches (152 mm).

E36. CORE ASSEMBLY

E36.1 In multi-pair cables the pairs shall be laid up symmetrically with lay not more than 15 times the assembled core diameter.

E36.2 Each subsequent layer of twisted pairs may be laid in a direction opposite to that of adjacent layers, or alternatively, unidirectional lay may be used. The outer layer shall be left hand lay.

E36.3 Fillers shall be used when necessary to secure a uniform assembly of conductors or a firm compact cylindrical core. The core shall be fabricated to ensure the smallest possible core diameter.

E37. FILLERS

E37.1 Fillers shall be used when necessary to ensure a firm compact cylindrical core. The core shall be fabricated so as to ensure **the smallest possible core diameter**. Fillers, when used, shall be of a non-metallic, moisture-resistant, non-wicking material which shall have no injurious effect upon other component parts of the cable. The filler shall not wick when tested as follows: One inch (25.4 mm) of the jacket shall be removed from one end of a one foot (0.305 m) length of cable. This end shall be supported vertically in a two inch (50.8 mm) deep dye (Gentian Violet or equivalent) and water solution for 24 hours. The dye shall not have visibly coloured the top end of the cable.

E38. CABLE TAPE

E38.1 The conductor assembly shall be covered with a wrapping of a moisture-resistant tape applied so as to lap at least 10 percent of its width.

E39. SHIELDING

E39.1 The shield shall consist of a single fully annealed copper tape applied longitudinally or helically around the core. If applied longitudinally, it shall be corrugated. If helically, it must lap at least 15 percent of its width.

E39.2 The copper tape employed for the shield shall have a thickness of not less than 4 Mils (0.10 mm).

E39.3 Where splicing of the shielding tape is necessary the shield tape shall be joined during the manufacturing process by means of cold weld, electric weld or soldering with non-acid flux.

E40. RIPCORD

E40.1 Overtop of the taped (i.e. both moisture-resistant tape and copper shield) conductor assembly shall be supplied a single continuous length of nylon or polyester cord, known as the "ripcord." The ripcord shall be laid longitudinally along the taped and shielded cable core assembly, immediately underneath the jacket material. The purpose of the ripcord is to assist to skin and remove the jacket material.

E41. JACKET

E41.1 The taped conductor assembly and ripcord shall be covered with a tight fitting black thermoplastic polyethylene compound jacket suitable for exposure to sunlight, atmospheric temperatures and stresses reasonably expected in normal installation.

E41.2 The jacket shall be applied tightly over the core assembly and ripcord and it shall be smooth, free from holes, splits, blisters and other imperfections. The jacket material shall meet the requirements of Table 41.2.

TABLE 41.2 Physical Properties of Polyethylene Jacket

Property	Test Method	Requirements
Tensile strength	**ASTM D2633, Latest Rev.**	**1,700 Psi Min. (11.72 MPa)**
Elongation	**ASTM D2633, Latest Rev.**	**400% Min.**
Cold Bend	**ASTM D2633 at −55.0 ± 1.0°C**	**No Cracks**
Environmental Cracking	**ASTM D1693, Latest Rev.**	**No Cracks**
Absorption Coefficient	**ASTM D3349, Latest Rev.**	**3,200***

*** Certification of Compliance with this requirement issued by the manufacturer of the polyethylene compound shall suffice in lieu of testing of the finished cable jacket**.

E41.3 The thickness of the jacket shall be UNIFORM at all points along the circumference and shall be 45 Mils (1.14 mm) minimum average acceptable thickness, with a minimum acceptable thickness at any point of 36 Mils (0.91 mm) and maximum acceptable thickness of 54 Mils. The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1).

E41.4 The exterior surface of the jacket shall be smooth, free of wrinkles, grooves and undulations.

E41.5 The jacket shall be durable and tough, yet flexible and capable of readily being skinned by means of the ripcord.

TWO (2), OR FOUR (4), OR EIGHT (8) PAIRED POLYETHYLENE INSULATED, POLYETHYLENE JACKETED TRAFFIC SIGNAL CABLE WITH ALUMINUM/MYLAR SHIELDS AND RIPCORD

E42. SCOPE

E42.1 This specification covers two (2), or four (4), or eight (8) paired, polyethylene insulated, polyethylene jacketed traffic signal cable, rated 600 volts, with a ripcord and with aluminum/mylar shields on each conductor pair, for use in underground conduit or as aerial cable supported by a messenger, as traffic communications signalling cable or as lead-in cable for inductive loop detectors.

E43. GENERAL CONSTRUCTION

E43.1 Cable under this specification shall be composed of copper conductors individually insulated with heat-stabilized polyethylene. The insulated conductors shall be twisted into pairs. Each conductor pair shall have a bare metallic drain wire, with each conductor pair and its associated drain wire completely enclosed in an electrically continuous aluminum/mylar metallic shield. The shielded pairs shall be laid up in a compact cable form and the cable core bound with a suitable moisture-resistant tape. Over top of the moisture-resistant tape, shall be installed a single continuous length of cord (the “ripcord”). The cable core, moisture-resistant tape, and ripcord shall be completely enclosed in a polyethylene compound jacket.

E44. CONDUCTORS

E44.1 The conductors shall be copper and shall, before insulating, conform to the requirements of ASTM [American Society for Testing and Materials] Designation B-3, latest revision.

E44.2 The conductors shall be solid.

E44.3 **Four (4), or Eight (8) or Sixteen (16)** individual conductors shall be supplied, each conductor # 14 AWG [American Wire Gauge] and twisted to form **two (2), or four (4), or eight (8)** individually shielded conductor **pairs**.

E45. INSULATION

E45.1 The insulating compound shall be polyethylene.

E45.2 The insulation shall be applied concentrically about the conductor. The minimum acceptable average thickness of the insulation shall be not less than 25 mils (0.635 mm). The minimum acceptable thickness at any point shall be 22 mils (0.569 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI [American National Standards Institute] C33.1).

E45.3 The insulation after application to the conductors shall comply with the requirements specified for Class 30 Thermoplastic Polyethylene compound in Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1), except that the temperature for the cold bend test shall be minus 55.0 ± 2.0° C.

E45.4 The insulation of the finished conductors before cabling shall withstand without break down the application of a 60 or 3,000 Hertz, 7,500 volt essentially sinusoidal spark test potential (RMS) in accordance with the method and using equipment specified in Underwriters Laboratories, Inc. Standard UL 83 (ANSI C33.8).

E46. IDENTIFICATION OF PAIRS

E46.1 The polyethylene compound used for conductor insulation shall be coloured, so as to identify (1) the "wire" and "mate" conductor for each pair and (2) each pair in the completed cable.

E46.2 Base colours shall be obtained by the use of coloured polyethylene insulating compound. "Tracers" shall be extruded coloured stripes which shall be an integral part of the insulation, formed in such a manner as to afford distinctive circuit colour coding throughout the length of each "mate" conductor. The coloured tracer shall form a continuous longitudinal or spiral line throughout the length of the "mate" conductor.

E46.3 The colours of each "wire" and "mate" conductor of each pair, together with the pair numbers shall be in accordance with the City of Winnipeg Traffic Signals Colour Code defined by Table 46.3.

TABLE 46.3 City of Winnipeg Traffic Signals Colour Code
Conductor Colour and Sequence for Two (2), or Four (4), or Eight (8) Paired Cables
[Varies from IMSA Specification 20-2 (1991), TABLE 62.3]

Pair No.	Wire Colour	Mate Colour
1	Black	Black with Green Tracer
2	Red	Red with Green Tracer
3	Orange	Orange with Green Tracer
4	Blue	Blue with Green Tracer
5	Green	Green with White Tracer
6	Brown	Brown with White Tracer
7	Slate	Slate with White Tracer
8	Violet	Violet with White Tracer

NOTE: Higher pair numbers represent the outer most conductors in the core.

E47. TWISTING

E47.1 The insulated conductors shall be twisted into pairs.

E47.2 Lengths of lay of pairs shall be staggered so, that pairs having the same length of lay shall be separated by at least two pairs having different lengths of lay.

E47.3 To help ascertain pair identity of the two wires comprising a pair, the maximum length of lay of pairs twisted shall not exceed six inches (152 mm).

E48. CORE ASSEMBLY

E48.1 In multi-pair cables the pairs shall be laid up symmetrically with lay not more than 15 times the assembled core diameter.

E48.2 Each subsequent layer of twisted pairs may be laid in a direction opposite to that of adjacent layers, or alternatively, unidirectional lay may be used. The outer layer shall be left hand lay.

E48.3 Fillers shall be used when necessary to secure a uniform assembly of conductors or a firm compact cylindrical core. The core shall be fabricated to ensure the smallest possible core diameter.

E49. DRAIN WIRE

E49.1 Each of the two (2), or four (4), or eight (8) individual drain wires associated with each conductor pair shall be a 7-strand tinned copper, non-insulated conductor, having a cross-sectional area and equivalent current-carrying capacity of a #19 AWG copper conductor.

E50. SHIELDING

E50.1 Each of the two (2), or four (4), or eight (8), shields shall consist of a single aluminum mylar tape applied longitudinally or helically over each individual conductor pair and attendant drain wire associated with each pair. If applied longitudinally it shall be corrugated. If helically, it must lap at least 15 percent of its width. The aluminum mylar shield tape shall be applied with its **aluminum** side facing **inward**, such that it faces the conductor pair (and attendant drain wire) for which it forms a shield, and its **mylar** side facing **outward**, facing the moisture-resistant tape layer.

E50.2 Each aluminum mylar shield shall completely cover one single twisted conductor pair, and shall also cover the attendant drain wire associated with each pair.

E50.3 The aluminum mylar tape employed for the shield shall have a thickness of not less than 1 Mil (0.025mm).

E50.4 Where splicing of the shielding tape is necessary the shield tape shall be joined during the manufacturing process by means of cold weld or electric weld. Any other process proposed by the manufacturer for splicing the shielding tape shall be submitted with complete manufacturing details and guaranteed performance specifications to the City of Winnipeg for approval prior to manufacture of the cable.

E51. FILLERS

E51.1 Fillers shall be used when necessary to ensure a firm compact cylindrical core. The core shall be fabricated so as to ensure **the smallest possible core diameter**. Fillers, when used, shall be of a non-metallic, moisture-resistant, non-wicking material which shall have no injurious effect upon other component parts of the cable. The filler shall not wick when tested as follows: One inch (25.4 mm) of the jacket shall be removed from one end of a one foot (0.305 m) length of cable. This end shall be supported vertically in a two inch (50.8 mm) deep dye (Gentian Violet or equivalent) and water solution for 24 hours. The dye shall not have visibly coloured the top end of the cable.

E52. CABLE TAPE

E52.1 The conductor assembly shall be covered with a wrapping of a moisture-resistant tape applied so as to lap at least 10 percent of its width.

E53. RIPCORD

E53.1 Overtop of the moisture-resistant tape (and immediately below the outer jacket material) shall be supplied a single continuous length of nylon or polyester cord, known as the “ripcord.” The ripcord shall be laid longitudinally along the entire length of cable core, immediately underneath the outer jacket material. The ripcord may be moulded into the inner surface of the outer jacket material. The ripcord shall be no larger than 20 mils (0.508 mm) in total diameter, and shall be constructed of either one or two strands, sufficiently strong to sever the jacket material without breaking. The purpose of the ripcord is to assist to skin and remove the jacket material.

E54. JACKET

E54.1 The taped conductor assembly and ripcord shall be covered with a tight fitting black thermoplastic polyethylene compound jacket suitable for exposure to sunlight, atmospheric temperatures and stresses reasonably expected in normal installation.

E54.2 The jacket shall be applied tightly over the core assembly and ripcord and it shall be smooth, free from holes, splits, blisters and other imperfections. The jacket material shall meet the requirements of Table 54.2.

TABLE 54.2 Physical Properties of Polyethylene Jacket

Property	Test Method	Requirements
Tensile strength	**ASTM D2633, Latest Rev.**	**1,700 Psi Min. (11.72 Mpa Min.)**
Elongation	**ASTM D2633, Latest Rev.**	**400% Min.**
Cold Bend	**ASTM D2633 at −55.0 ± 1.0°C**	**No Cracks**
Environmental Cracking	**ASTM D1693, Latest Rev.**	**No Cracks**
Absorption Coefficient	**ASTM D3349, Latest Rev.**	**3,200***

*** Certification of Compliance with this requirement issued by the manufacturer of the polyethylene compound shall suffice in lieu of testing of the finished cable jacket**.

E54.3 The thickness of the jacket shall be UNIFORM at all points along the circumference, and **for two (2) and four (4) pair cables** shall be 45 Mils (1.14 mm) minimum average acceptable thickness, with a minimum acceptable thickness at any point of 36 Mils (0.91 mm) and maximum acceptable thickness of 54 Mils (1.37 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1).

E54.4 The thickness of the jacket shall be UNIFORM at all points along the circumference and **for eight (8) pair cable** shall be 54 Mils (1.37 mm) minimum average acceptable thickness, with a minimum acceptable thickness at any point of 48 Mils (1.22 mm) and maximum acceptable thickness of 60 Mils (1.52 mm). The method of measurement and the apparatus used shall be in accordance with Underwriters Laboratories, Inc. Standard UL 62 (ANSI C33.1).

E54.5 The exterior surface of the jacket shall be smooth, free of wrinkles, grooves and undulations.

E54.6 The jacket shall be durable and tough, yet flexible and capable of readily being skinned by means of the ripcord.