THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 135-2007

WINNIPEG WATER TREATMENT PROGRAM – LEASE OF LIQUID OXYGEN STORAGE EQUIPMENT AND SUPPLY OF LIQUID OXYGEN

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B1. CONTRACT TITLE

B1.1 WINNIPEG WATER TREATMENT PROGRAM – LEASE OF LIQUID OXYGEN STORAGE EQUIPMENT AND SUPPLY OF LIQUID OXYGEN

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 4:00 p.m. Winnipeg time, July 25, 2007.

B2.2 Bids 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. SITE INVESTIGATION

B3.1 Further to GC.2.01, the Bidder may make an appointment to view the Site by contacting the Contract Administrator.

B3.2 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

B4.2 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 promptly notify the Contract Administrator of the error, discrepancy or omission at least five (5) Business Days prior to the Submission Deadline.

B4.3 If the Bidder is unsure of the meaning or intent of any provision therein, the Bidder should request clarification as to the meaning or intent prior to the Submission Deadline.

B4.4 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.

B4.5 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.

B4.6 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.

B5. ADDENDA

B5.1 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.

B5.2 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.

B5.2.1 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.

B5.2.2 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 regularly and shortly before the Submission Deadline, as may be amended by addendum.

B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6. SUBSTITUTES

B6.1 The Work is based on the materials, equipment, methods and products specified in the Bid Opportunity.

B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B6.3 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.

B6.4 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;

(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.

B6.5 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.

B6.6 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.

B6.6.1 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.

B6.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B6.8 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 B16.

B6.9 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.

B6.10 Any deviations in the Bid to the General Conditions, as may be amended by the Supplemental Conditions in the Bid Opportunity, will be evaluated and may in the City's sole discretion, result in the Bid being determined to be non-responsive in accordance with B16.1(a).

B7. BID SUBMISSION

B7.1 The Bid shall consist of the following components:

(a) Form A: Bid;

(b) Form B: Prices;

(c) Form N: Commodity Price Adjustment Factors;

(d) Form G1: Bid Bond and Agreement to Bond, or
Form G2: Irrevocable Standby Letter of Credit and Undertaking, or
a certified cheque or draft.

B7.2 All components of the Bid 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, to constitute a responsive Bid.

B7.3 The Bid Submission shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.3.1 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.

B7.4 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.

B7.5 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, may result in the Bid being determined to be non-responsive.

B7.6 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.7 Bids shall be submitted to:

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

B8. BID

B8.1 The Bidder shall complete Form A: Bid, making all required entries.

B8.2 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;

(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.

B8.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.

B8.3 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.

B8.4 Paragraph 12 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 the corporate seal, if the corporation has one, should be affixed;

(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.

B8.4.1 The name and official capacity of all individuals signing Form A: Bid shall be printed below such signatures.

B8.4.2 All signatures should be witnessed, except where a corporate seal has been affixed.

B8.5 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 and the Contract, when awarded, shall be both joint and several.

B9. PRICES

B9.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B9.1.1 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;

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

B9.2 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.

B9.2.1 With reference to item 2 on Form B: Prices, the approximate quantity shown for the baseline LOX commodity charge is an estimate of the City’s requirement from this LOX Facility for a period of five (5) years. The City will use said quantity for the purposes of comparing Bids.

B9.3 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.

B10. COMMODITY PRICE ADJUSTMENT FACTORS

B10.1 The Bidder shall submit Form N: Commodity Price Adjustment Factors indicating certain information that will be used in the Bid evaluation and in the weighted cost adjustment calculation that will be used for measurement and payment throughout the performance of the Work.

B10.2 The Bidder shall indicate on Form N: Commodity Price Adjustment Factors weighting to be applied to the energy, labour and diesel fuel cost components of the calculation specified in D24.

B10.2.1 The Sum of the weighting factors for power, labour and fuel shall equal 100% as follows:

$$N_{Power} + N_{Labour} + N_{Fuel} = 100\%$$

Where:

N_{Power}	= weighting (%) of the energy costs component of commodity price adjustment to be used in the calculation specified in D24
N_{Labour}	= weighting (%) of the labour costs component of commodity price adjustment to be used in the calculation specified in D24
N_{Fuel}	= weighting (%) of the diesel fuel cost component of commodity price adjustment to be used in the calculation specified in D24

B10.3 The Bidder shall indicate on Form N: Commodity Price Adjustment Factors:

(a) the baseline energy (P_0) and diesel fuel (F_0) costs, in effect at the Bid Submission Deadline, that will be applied to the calculation specified in D24;

(b) the bidder shall indicate the annual labour rate increase that will be applied to the calculation specified in D24.

B10.4 The Bidder shall indicate in items 6.0 and 7.0 on Form N: Commodity Price Adjustment Factors the indices which shall be used in calculating the energy cost component (P_N) and diesel fuel cost component (F_N) of the Commodity Price Adjustment Mechanism specified in D24.2. The proposed indices must:

(a) Be based on indices which can be verified through independent sources (i.e. published or posted publicly);

(b) Result in not more than one adjustment per month to the LOX Commodity component of the Total Unit Price;

(c) Result in price adjustments occurring on a regular periodic basis; and

(d) Be determinable, i.e., conditions such as “to be determined” or “to be negotiated” or similar wording will be deemed non-responsive.

B10.5 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, a written record of the proposed indices for at least the most recent thirty-six (36) month period available for any of the Commodity Price Adjustment indices.

B11. QUALIFICATION

B11.1 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; and

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

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

B11.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

(a) be responsible and not be suspended, debarred or in default of any obligations 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.

B11.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

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

(b) be fully capable of performing the Work required to be in strict accordance with the terms and provisions of the Contract; and

(c) have a written workplace safety and health program, if required, pursuant to The Workplace Safety and Health Act (Manitoba);

B11.4 Further to B11.1(c), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator that the Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

(a) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association or by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or

(b) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template 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.)

B11.5 The Bidder shall 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.

B11.6 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.

B12. BID SECURITY

B12.1 The Bidder shall provide bid security in the form of:

(a) a bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in Manitoba, in the form included in the Bid Submission (Form G1: Bid Bond and Agreement to Bond); or

(b) an irrevocable standby letter of credit, in the amount of at least ten percent (10%) of the Total Bid Price, and undertaking issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form included in the Bid Submission (Form G2: Irrevocable Standby Letter of Credit and Undertaking); or

(c) a certified cheque or draft payable to "The City of Winnipeg", in the amount of at least fifty percent (50%) of the Total Bid Price, drawn on a bank or other financial institution registered to conduct business in Manitoba.

B12.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B12.1.2 All signatures on bid securities shall be original, and shall be witnessed or sealed as required.

B12.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

B12.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B12.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B12.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B12.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

B13. OPENING OF BIDS AND RELEASE OF INFORMATION

B13.1 Bids will not be opened publicly.

B13.2 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.

B13.3 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.

B13.4 The Bidder is advised that any information contained in any Bid 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.

B14. IRREVOCABLE BID

B14.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B14.2 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 11 of Form A: Bid.

B15. WITHDRAWAL OF BIDS

B15.1 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.

B15.1.1 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.

B15.1.2 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 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B15.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

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

(b) open the Bid to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and

(c) if the notice has been given by any one of the persons specified in B15.1.3(b), declare the Bid withdrawn.

B15.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B14.2 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, including the right to retain the Bidder's bid security.

B16. EVALUATION OF BIDS

B16.1 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 B11 (pass/fail);

(c) Total Bid Price;

(d) economic analysis of any approved alternative pursuant to B6.

B16.2 Further to B16.1(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 or minor informalities or irregularities if the interests of the City so require.

B16.3 Further to B16.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid or in other information required to be submitted, that he is responsible and qualified.

B16.4 Further to B16.1(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.

B16.4.1 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.

B16.4.2 This Contract will be awarded as a whole.

B17. AWARD OF CONTRACT

B17.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B17.2 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.

B17.2.1 Without limiting the generality of B17.2, 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.

B17.3 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.

B17.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

B17.4 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 the Contract.

B17.5 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 construction of a LOX Facility, the lease of LOX storage equipment, and the supply of LOX to the Site for a period starting at Substantial Performance and ending on September 30, 2012.

D2.1.1 The City may, at its sole option, extend the Contract Time by a period of up to five (5) years.

D2.1.2 The Site is located on Provincial Road 207, 3.2 km north of Highway 1 in Dugald, Manitoba. The Site address is PR 207, Lot 57082, Dugald, Manitoba.

D2.2 The major components of the Work are as follows:

(a) The provision of the engineering design, sealed by a Professional Engineer, for the foundation required to support and operate the LOX Facility.

(b) The supply, installation, maintenance and operation of a LOX Facility at the WTP Site.

(c) Monitoring inventories and supply of an uninterrupted supply of LOX to the edge of the LOX Facility in accordance with the Contract Documents from Substantial Performance until Total Performance.

(i) Estimates of LOX usage specified in the Contract Documents is based on the WTP operating at steady-state. During the Commissioning Period, the City will have a highly variable demand for LOX depending on the Performance Verification schedule of equipment supplied and installed by the City under other contracts. The Commissioning Period is estimated to last two hundred (200) Calendar Days.

(ii) The Contractor shall store critical spare parts that are required to ensure uninterrupted supply as specified in Section 11211-A. The spare parts will be stored on Site by the City, but will remain the property of the Contractor. Any maintenance required for spare parts provided by the Contractor to ensure an uninterrupted supply is the responsibility of the Contractor.

(d) Leasing of the LOX Facility from Substantial Performance of the installation of the LOX Facility to Total Performance.

(e) Removal of the LOX Facility prior to the completion of the Work in the event that the City chooses not to extend the Contract Time pursuant to D2.1.1.

(f) Supply an uninterrupted supply of LOX during the removal of the LOX Facility including, but not limited to, supplying from temporary sources for a period of up to fifteen (15) Calendar Days following the removal of the LOX Facility if required.

D2.3 The City will:

(a) Construct the foundation required for the LOX Facility in accordance with the engineered design provided by the Contractor pursuant to D2.2(a).

(b) Provide road access to the LOX Facility and allow the Contractor access 24 hours per day, 7 days a week in order to make deliveries. The Contractor shall provide the Contract Administrator with a minimum of four (4) hours advance notice of any deliveries.

(c) Provide a fence around the LOX Facility in accordance with the City of Winnipeg Standard Construction Specification CW3550.

(d) Supply and install one 120V, 20A weatherproof duplex receptacle for convenience power at a location within the LOX Facility as required by the Contractor.

(e) Supply and install 600V power to the LOX Facility for energizing the trim heaters. Final connection shall be by the Contractor.

(f) Supply and install wiring for one telephone line (including service) to a location within the LOX Facility as required by the Contractor.

(g) Supply and install Site lighting to facilitate night deliveries.

D3. DEFINITIONS

Not withstanding GC.1.01, 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) **Award Authority** means the authority having jurisdiction to award the Contract according to the City's by-laws, policies or procedures

(d) **Commodity Price Adjustment** means the equation specified in D24 that will be used to determine the commodity charges payable by the City at anytime during the performance of the Work

(e) **LOX Source Location** means the location where the LOX supplied under this Contract is manufactured

(f) **LOX Facility** means all Materials and equipment supplied, installed and operated by the Contractor at the Site for the storage and delivery of LOX in accordance with the Contract Documents

(g) **Award Authority** means the authority to have the jurisdiction to award the Contract according to the City's by-laws, policies or procedures

(h) **Sm^3** means standard cubic meter and is the unit of mass equal to the mass of 1 cubic metre of gas at a pressure of 1 atmosphere and temperature of 15°C

(i) **Substantial Performance** shall mean the completion of Performance Verification

(j) **ANSI** means American National Standards Institute

(k) **ASME** means American Society of Mechanical Engineers

(l) **ASTM** means American Society for Testing and Materials

(m) **AWWA** means American Water Works Association

(n) **CSA** means Canadian Standards Association

(o) **DAF** means Dissolved Air Flotation

(p) **IEC** means International Electrotechnical Commission

(q) **ISO** means International Organization for Standardization

(r) **NACE** means National Association of Corrosion Engineers

(s) **NEMA** means National Electrical Manufacturers Association

(t) **NSF** means National Sanitation Foundation

(u) **SAE** means Society of Automotive Engineers

(v) **Manufacturer** means the person, partnership or corporation responsible for the manufacture and fabrication of equipment supplied by the Contractor for the completion of the Work

(w) **Manufacturer's Representative** means a trained serviceman empowered by the Manufacturer to provide installation, testing, and commissioning assistance to the Contractor in his performance of those functions

(x) **IEEE** means Institute of Electrical and Electronics Engineers

(y) **NEMA** means National Electrical Manufacturer's Association

(z) **Furnish** means supply

(aa) **LOX** means liquid oxygen

(bb) **GOX** means gaseous oxygen

(cc) **Contract Work Schedule** means a Gantt Charter developed by the Contractor developed using the critical path method which shows the proposed progress of the major items of work which are to be performed under this Contract

(dd) **Project Master Schedule** means a schedule developed by the Contract Administrator which includes and coordinates the Contract Work Schedules of several City contracts, including this Contract

(ee) **Professional Engineer** means a professional engineer registered in the Province of Manitoba

(ff) **Performance Verification** means all factory and field tests, demonstrations and other activities required from the Contractor to complete all required Forms 103 – Certificate of Satisfactory Performance and to demonstrate to the Contract Administrator's satisfaction that the equipment installed under this Contract is performing as specified herein

(gg) **Acceptable Shop Drawings** means all required Shop Drawings have been reviewed by the Contract Administrator and have been annotated and stamped as "reviewed" or "reviewed as modified" in accordance with Section 01300 of this Bid Opportunity

(hh) **Process Unit** means a complete equipment package supplied either by the Contractor or as part of City Supplied Equipment and which includes individual process components, skid mounted equipment and any related appurtenances

(ii) **Control System Integrator** means a contractor retained by the City (under a different contract) to program and configure the water treatment plant SCADA system

(jj) **Systems Integrator** means Control System Integrator

(kk) **SCADA** means supervisor control and data acquisition

(ll) **WTP** means the Winnipeg Water Treatment Plant and includes the structure and all equipment and materials supplied and installed into the building, under multiple construction contracts, including portions of the Work provided under this Contract

(mm) **Commissioning Period** means the time between the completion of Performance Verification and Total Performance during which a system is operated under the control of the City to demonstrate that the process equipment that consumes the LOX operates in accordance with the design intent

(nn) **Commissioning Operations Agent** means a qualified maintenance/operations team that takes primary responsibility for operation and maintenance of the WTP during the System Demonstration Period

(oo) **System Demonstration Period** means a period during the Commissioning Period during which there is successful operation of process treatment trains in accordance with their design requirements for a total period of forty-two (42) Calendar Days, the last seven (7) of which shall be consecutive, unless otherwise specified

(pp) **Certified Shop Drawings** means Shop Drawings prepared by the Contractor after all required Shop Drawings have been "reviewed" or "reviewed as modified" in accordance with Section 01300 of this Bid Opportunity and which incorporate all modifications to the Shop Drawings, comments and notations made by the Contract Administrator in the course of the review

(qq) **Record Drawings** means a minimum of one (1) complete set of Contract Documents and Certified Shop Drawings maintained at the Contractor's Site office on which the Contractor clearly shall clearly record in red pencil all Addenda, Change Orders, Field Instructions, and other revisions or as-built conditions which deviate from the original Contract Documents or Certified Shop Drawings.

(rr) **O&M** means operation and maintenance

(ss) **I&C** means instrumentation and control

(tt) **NFPA** means National Fire Protection Association

(uu) **OSHA** means Occupational Safety and Health Act

(vv) **Vendor Package** means a manufactured equipment package supplied and installed by the Contractor

D3.2 The definitions of technical terms, abbreviations, and symbols will be those of the American Society for Testing and Materials, Canadian Standards Association and the applicable Codes and Standards unless otherwise specified herein.

D3.3 Unless otherwise specified, the latest edition of all referenced standards (including amendments and supplements) in effect on the date of issue of the Bid Opportunity shall apply to the Work.

D3.4 The Manufacturer and Manufacturer's Representative are not parties to this Contract. All work required from the Manufacturer and Manufacturer's Representative shall be provided and coordinated by the Contractor.

D3.5 Specialized terms relating to instrumentation and control and which are not explicitly defined herein shall be as defined in The Instrumentation Systems and Automation Society (ISA) S51.1, National Electrical Manufacturer's Association (NEMA) Industrial Control and Systems (ICS) 1, American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE) Std 100, and the Communications Standard Dictionary, by Martin H. Weik.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is UMA Projects (CM) Ltd., represented by:

Bill Richert, P.Eng.
1479 Buffalo Place
Winnipeg, MB, R3T 1L7

e-mail: bill.richert@uma.aecom.com

Telephone No. (204) 986-6053
Facsimile No. (204) 986-8393

D4.2 At the pre-construction meeting, the Contract Administrator will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

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 following address or facsimile number:

The City of Winnipeg
Chief Administrative Officer Secretariat
Attn: Chief Administrative Officer
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
Attn: City Solicitor
185 King Street, 3rd Floor
Winnipeg MB R3B 1J1

Facsimile No.: (204) 947-9155

D6. INDEMNITY

D6.1 Notwithstanding GC.7.03, the Contractor shall save harmless and indemnify the City for twice the value of LOX supplied for the preceding twelve (12) months plus two (2) million dollars against all costs, damages or expenses arising from actions, claims, demands and proceedings, by whomsoever brought, made or taken as a result of negligent acts or omissions of the Contractor, his/her Subcontractors, employees or agents in the performance or purported performance of the Work, and more particularly from:

(a) accidental injury to or death of any person whether retained by or in the employ of the Contractor or not, arising directly or indirectly by reason of the performance of the Work, or by reason of any trespass on or damage to property;

(b) damage to any property owned in whole or in part by the City, or which the City by duty or custom is obliged, directly or indirectly, in any way or to any degree, to construct, repair or maintain;

(c) damage to, or trespass or encroachment upon, property owned by persons other than the City;

(d) failure to pay and obtain a discharge of a notice of claim for lien served upon the City in accordance with the requirements of The Builder's Liens Act;

(e) failure to pay a Workers Compensation assessment, or Federal or Provincial taxes;

(f) unauthorized use of any design, device, material or process covered by letters patent, copyright, trademark or trade name in connection with the Work;

(g) inaccuracies in any information provided to the City by the Contractor.

D6.2 Notwithstanding GC.7.03, the Contractor shall not be liable for indirect or punitive damages.

SUBMISSIONS

D7. AUTHORITY TO CARRY ON BUSINESS

D7.1 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.

D8. WORKERS COMPENSATION

D8.1 The Contractor shall be registered with the Workers Compensation Board of Manitoba, shall provide and maintain Workers Compensation coverage throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D9. INSURANCE

D9.1 The City will provide and maintain the following Project Insurance Coverages from award until December 31, 2008:

(a) Builder's Risk Insurance in the amount of one hundred percent (100%) of the total project cost.

(i) The Contractor shall be responsible for deductibles up to $25,000.00 maximum of any one loss.

(b) Wrap-Up Liability Insurance in an amount of no less than 10 million dollars ($10,000,000.00).

(i) The Contractor shall be responsible for deductibles up to $25,000.00 maximum of any one loss.

(c) The City of Winnipeg will carry such insurance to cover all parties engaged in the Work in this Contract. Provision of this insurance by the City of Winnipeg is not intended in any way to relieve the Contractor from his obligations under the terms of the Contract. Specifically, losses relating to deductibles for insurance, as well as losses in excess of limits of coverage and any risk of loss that is not covered under the terms of the insurance provided by the City of Winnipeg remains with the Contractor.

D9.2 The Contractor shall provide and maintain the following insurance coverage at all times during the performance of the Work:

(a) Automobile liability insurance for owned and non-owned automobiles used for or in connection with the work in the amount of at least two million dollars ($2,000,000.00).

(i) Deductibles shall be borne by the Contractor;

(ii) The Contractor shall not cancel, materially alter, or cause the policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator;

(iii) The Contractor shall provide the Contract Administrator with evidence of insurance of the policy at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than seven (7) Calendar Days from notification of the award of Contract.

D9.3 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

D10. MATERIAL SAFETY DATA SHEETS

D10.1 The Contractor shall provide the Contract Administrator with one (1) copy of Material Safety Data Sheets (MSDS's) for each product to be supplied under the Contract at least two (2) Business Days prior to the commencement of Work but in no event later than the date specified in GC.3.01 for the return of the executed Contract.

D10.2 Throughout the term of the Contract, the Contractor shall provide the Contract Administrator with revisions or updates of the MSDS's as soon as may be reasonably possible.

D11. PERFORMANCE SECURITY

D11.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

(a) a performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the estimated annual price; or

(b) an irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the estimated annual price; or

(c) a certified cheque or draft payable to "The City of Winnipeg", drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the estimated annual price.

D11.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D11.2 If the bid security provided in his Bid was not a certified cheque or draft pursuant to B12.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of and prior to the commencement of any Work on the Site.

D12. SUBCONTRACTOR LIST

D12.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site.

D13. DETAILED WORK SCHEDULE

D13.1 The Contract Administrator has developed a Project Master Schedule for the project. This schedule will be available in the offices of the Contract Administrator and will be updated as required as the Work progresses.

D13.2 The Contractor shall, within 5 business days of award of contract, prepare a detailed Contract Work Schedule for his Work.

D13.3 The Contract Work Schedule shall conform to the Project Master Schedule and show, in a clear graphical manner, through the use of Gantt charts, in a maximum of weekly stages, the proposed progress of the main items, structures and subtrades of the Contract and indicate the labour, construction crews, plant and equipment to be employed. Indicate the delivery date of major pieces of equipment to be supplied. The schedule shall be predicated on the completion of all work on or before the date of Substantial Performance.

D13.4 Upon acceptance by the Contract Administrator, distribute copies of the revised Contract Work Schedule to Subcontractors and other concerned parties.

D13.5 The Contract Work Schedule shall be updated as the work requires and submitted to the Contract Administrator.

D13.6 The Contractor shall instruct recipients to report to the Contractor immediately any problems anticipated by the timetable shown in the Contract Work Schedule.

D13.7 While it is intended that the Contractor shall be allowed, in general, to carry on the Contract in accordance with such general plans as may appear to him to be most desirable, the Contract Administrator, at his discretion, may direct the order in which, and points at which, the Work shall be undertaken.

D13.8 This control shall be exercised in the interests of the City so that the work of other Contractors who may be working on the Site may be coordinated with the Work on this Contract. A program of work will be drawn up and agreed to before the commencement of the Contract.

D13.9 The Contractor shall notify the Contract Administrator immediately when the Work under the Contract Work Schedule will adversely affect the work of other contractors and the critical path of the Project Master Schedule as the work under the Contractor's Contract Work Schedule is an integral part of the Project Master Schedule.

D13.10 The Contractor shall be familiar with all other Contract Work Schedules as contracted by the City with other Contractors and the critical path of the Project Master Schedule.

D14. SECURITY CLEARANCE

D14.1 Each individual proposed to perform Work on the Site shall be required to obtain a Criminal Record Check Search Certificate from the Police Service having jurisdiction at his place of residence.

D14.2 Prior to the commencement of any Work, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Contract Administrator with a Criminal Record Search Certificate obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform Work within City facilities or on private property.

D14.3 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to property offences or crimes against another person, will not be permitted to perform any Work within City facilities or on private property.

D14.4 Any Criminal Record Search Certificate obtained thereby will be deemed valid for the duration of the Contract subject to a repeated records search as hereinafter specified.

D14.5 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a repeated criminal records search will not be permitted to continue to perform Work under the Contract within City facilities or on private property.

SCHEDULE OF WORK

D15. COMMENCEMENT

D15.1 The Contractor shall not commence any Work until he is in receipt of a notice of award from the City authorizing the commencement of the Work.

D15.2 The Contractor shall not commence any Work on the Site until:

(a) the Contract Administrator has confirmed receipt and approval of:
  (i) evidence of authority to carry on business specified in D7;
  (ii) evidence of the workers compensation coverage specified in D8;
  (iii) evidence of the insurance specified in D9;
  (iv) the Material Safety Data Sheets specified in D10;
  (v) the performance security specified in D11;
  (vi) the Subcontractor list specified in D12;
  (vii) the detailed work schedule specified in D13; and
  (viii) the security clearances specified in D14.

(b) the Contractor has attended a meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a meeting.

D16. CRITICAL STAGES

D16.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

(a) Provide Acceptable Shop Drawings for the design of the LOX Facility foundation within forty (40) Business Days of the award of the Contract pursuant to B17.

D17. SUBSTANTIAL PERFORMANCE

D17.1 The Contractor shall achieve Substantial Performance no earlier than September 1, 2008 and no later than October 31, 2008.

D17.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D17.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.

D17.4 Substantial Performance cannot be achieved without the completion of Form 103: Certificate of Satisfactory Equipment Performance.

D18. TOTAL PERFORMANCE

D18.1 The Contractor shall achieve Total Performance by September 30, 2012.

D18.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D18.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

D19. LIQUIDATED DAMAGES

D19.1 If the Contractor fails to achieve Substantial Performance in accordance with the Contract by the day fixed herein for Substantial Performance, the Contractor shall pay the City two thousand

six-hundred dollars ($2,600) per Calendar Day for each and every Calendar Day following the day fixed herein for Substantial Performance during which such failure continues.

D19.2 If the Contractor fails to achieve the critical stages specified in D16 in accordance with the Contract by the day fixed herein for the critical stages, the Contractor shall pay the City two thousand six-hundred dollars ($2,600) per Calendar Day for each and every Calendar Day following the day fixed herein for each critical stage during which such failure continues.

D19.3 The amount specified for liquidated damages in D19.1 and D19.2 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Substantial Performance by the day fixed herein for same.

D19.4 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

CONTROL OF WORK

D20. JOB MEETINGS

D20.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D20.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D21. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D21.1 Further to GC.5.02, prior to the completion of the Commissioning Period, UMA Projects (CM) Ltd. shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

(a) As Prime Contractor, UMA Projects (CM) Ltd. will administer a Safety and Health Management Plan. Compliance with this Plan will be mandatory for all personnel on the construction site and orientation of all staff by the Prime Contractor’s Safety Officer will be required.

(b) The Water Treatment Program Project Safety and Health Management Plan is available on the City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt/projects .

D21.2 Following the completion of the Commissioning Period, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba) for all portions of the Work performed at the LOX Facility.

D22. SAFETY

D22.1 Except as specified in D21, the Contractor shall be solely responsible for the safe operation of the LOX Facility during the performance of the Work.

D22.2 If the Contractor determines that his supply obligations under the Contract pose an unreasonable risk to the LOX Facility or any employees, agents or invitees of the City or Contractor, he may suspend his supply obligations without notice and shall provide the Contract Administrator with written justification for such action within one (1) Calendar Day.

D23. FORCE MAJEURE

D23.1 If the Contractor is unable to fully perform the Work due to circumstances beyond his reasonable control, as specified in GC.8.04, and the Work can not be performed in accordance with the requirements of the Contract, then the Contractor shall make every effort to obtain replacement product from other sources including dividing its available product amongst its customers.

D23.2 If the City declines such replacement product, it may purchase its required quantity from an alternate source until such time as the Force Majeure event has passed and the Contractor is once again able to meet the supply requirements of the Contract.

D23.3 If the City proceeds in accordance with D23.2, then the City shall pay all costs associated with establishing the supply of the replacement product, including costs associated with cleaning the LOX Facility prior to re-establishing normal supply by the Contractor once the Force Majeure event has passed.

MEASUREMENT AND PAYMENT

D24. PAYMENT SCHEDULE

D24.1 Further to GC.9.03, payment shall be in accordance with the following:

(a) All payments shall be F.O.B. WTP and shall be based on the volume of LOX delivered by the Contractor. Measurement of each delivery of LOX shall be made by the Contractor using devices designed for the measurement of cryogenic liquids as allowed for by paragraphs 7(1)(a) and 7(1)(c) of the Weights and Measures Regulations (Ch. 1605, Consolidated Regulations of Canada, 1978 as amended).

(b) All measuring devices shall be calibrated by the Contractor at least once for each 12 month period of the Contract and shall maintain an accuracy between 4% of under-registration and 2% of over registration. The Contractor shall provide the Contract Administrator with evidence of such documentation upon request.

D24.2 The quantity measured in accordance with D24.1(a) shall be paid at unit price rate shown on Form B: Prices, and as adjusted on the first Calendar Day of each month in accordance with the following calculation:

$$LOX_N = \{N_{Power} \times (P_N \div P_0)\} + \{N_{Labour} \times (L_N)\} + \{N_{Fuel} \times (F_N \div F_0)\} \times LOX_0$$

Where:

LOX_N	= Commodity cost of LOX in dollars per Sm^3 at any time during the performance of the Work.
LOX_0	= Commodity cost of LOX in dollars per Sm^3 at the Bid Submission Deadline as shown in item 2 of Form B: Prices
N_{Power}	= weighting (%) of the energy costs component of Commodity Price Adjustment
N_{Labour}	= weighting (%) of the labour costs component of Commodity Price Adjustment
N_{Fuel}	= weighting (%) of the diesel fuel cost component of Commodity Price Adjustment
P_N	= Energy cost at any time during the performance of the Work based on the cost index shown in item 6.0 of Form N: Commodity Price

	Adjustment Factors.
P_0	= Baseline energy cost at the Bid Submission Deadline based on the cost index shown in item 6.0 of Form N: Commodity Price Adjustment Factors..
L_N	= The ratio of Labour Cost at any time during the performance of the Work to the Labour cost at the Bid Submission Deadline, based on the.annual labour cost adjustment specified in 8.0 of Form N: Commodity Price Adjustment Factors and the following: $L_N = (1+ L_{ADJ})^N$ Where: N = the number of years that the Work has been performed since award of the Contract. Immediately after award of the Contract; N shall be zero (0) and shall increase by unity (1) once annually on the date specified in 9.0 of Form N: Commodity Price Adjustment Factors.
F_N	= Diesel fuel cost at any time during the performance of the Work based on the cost index shown in item 7.0 of Form N: Commodity Price Adjustment Factors.
F_0	= Diesel fuel cost at the Bid Submission Deadline based on the cost index shown in item7.0 of Form N: Commodity Price Adjustment Factors..

D24.3 The measurement and payment for LOX supplied by the Contractor pursuant to D2.2(f) shall be in accordance with D24.1 and D24.2.

D24.4 The measurement and payment during an extension period specified by the City pursuant to D2.1.1 shall be in accordance with D24.1 and D24.2.

D24.5 The construction of the LOX Facility by the Contractor is incidental to the Work, and the City will not be advancing progress payments to the Contractor during its construction.

D24.5.1 The Contractor shall make prompt payment to his sub-contractors, his employees and his suppliers of materials and services and shall solely be responsible for the obligations and duties of owner and contractor pursuant to The Builders' Liens Act (Manitoba)

D24.5.2 The Contractor shall promptly secure a discharge of a lien or trust claim served upon the City pursuant to the Builders' Liens Act (Manitoba).

WARRANTY

D25. WARRANTY

D25.1 Further to GC.10.01, the Contractor is responsible to operate and maintain the LOX Facility during the performance of the Work.

D25.2 The Contractor shall supply LOX in accordance with the Specifications for the entire term of the Contract and makes no other warranty including, but not limited to, merchantability and fitness for a particular purpose.

FORM H1: PERFORMANCE BOND
(See D11)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

_____ ,
(hereinafter called the "Surety"), are held and firmly bound unto **THE CITY OF WINNIPEG** (hereinafter called the "Obligee"), in the sum of

_____

_____ dollars ($_____.____)

of lawful money of Canada to be paid to the Obligee, or its successors or assigns, for the payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has entered into a written contract with the Obligee dated the

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 135-2007

WINNIPEG WATER TREATMENT PROGRAM – LEASE OF LIQUID OXYGEN STORAGE EQUIPMENT AND SUPPLY OF LIQUID OXYGEN

which is by reference made part hereof and is hereinafter referred to as the “Contract”.

NOW THEREFORE the condition of the above obligation is such that if the Principal shall:

(a) carry out and perform the Contract and every part thereof in the manner and within the times set forth in the Contract and in accordance with the terms and conditions specified in the Contract;
(b) perform the Work in a good, proper, workmanlike manner;
(c) make all the payments whether to the Obligee or to others as therein provided;
(d) in every other respect comply with the conditions and perform the covenants contained in the Contract; and
(e) indemnify and save harmless the Obligee against and from all loss, costs, damages, claims, and demands of every description as set forth in the Contract, and from all penalties, assessments, claims, actions for loss, damages or compensation whether arising under "The Workers Compensation Act", or any other Act or otherwise arising out of or in any way connected with the performance or non-performance of the Contract or any part thereof during the term of the Contract and the warranty period provided for therein;

THEN THIS OBLIGATION SHALL BE VOID, but otherwise shall remain in full force and effect. The Surety shall not, however, be liable for a greater sum than the sum specified above.

AND IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable as Principal, and that nothing of any kind or matter whatsoever that will not discharge the Principal shall operate as a discharge or release of liability of the Surety, any law or usage relating to the liability of Sureties to the contrary notwithstanding.

IN WITNESS WHEREOF the Principal and Surety have signed and sealed this bond the

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

By: _____ (Seal)
(Attorney-in-Fact)

FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)
(See D11)

_____
(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 135-2007

WINNIPEG WATER TREATMENT PROGRAM – LEASE OF LIQUID OXYGEN STORAGE EQUIPMENT AND SUPPLY OF LIQUID OXYGEN

Pursuant to the request of and for the account of our customer,

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

WE HEREBY ESTABLISH in your favour our irrevocable Standby Letter of Credit for a sum not exceeding in the aggregate

_____

_____ Canadian dollars.

This Standby Letter of Credit may be drawn on by you at any time and from time to time upon written demand for payment made upon us by you. It is understood that we are obligated under this Standby Letter of Credit for the payment of monies only and we hereby agree that we shall honour your demand for payment without inquiring whether you have a right as between yourself and our customer to make such demand and without recognizing any claim of our customer or objection by the customer to payment by us.

The amount of this Standby Letter of Credit may be reduced from time to time only by amounts drawn upon it by you or by formal notice in writing given to us by you if you desire such reduction or are willing that it be made.

Partial drawings are permitted.

We engage with you that all demands for payment made within the terms and currency of this Standby Letter of Credit will be duly honoured if presented to us at:

_____
(Address)

and we confirm and hereby undertake to ensure that all demands for payment will be duly honoured by us.

All demands for payment shall specifically state that they are drawn under this Standby Letter of Credit.

Subject to the condition hereinafter set forth, this Standby Letter of Credit will expire on

_____ .
(Date)

It is a condition of this Standby Letter of Credit that it shall be deemed to be automatically extended from year to year without amendment from the present or any future expiry date, unless at least 30 days prior to the present or any future expiry date, we notify you in writing that we elect not to consider this Standby Letter of Credit to be renewable for any additional period.

This Standby Letter of Credit may not be revoked or amended without your prior written approval.

This credit is subject to the Uniform Customs and Practice for Documentary Credit (1993 Revision), International Chamber of Commerce Publication Number 500.

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST
(See D12)

WINNIPEG WATER TREATMENT PROGRAM – LEASE OF LIQUID OXYGEN STORAGE EQUIPMENT AND SUPPLY OF LIQUID OXYGEN

Name	Address

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

E1.1 These Specifications shall apply to the Work.

Specifications:

Division 1

Section No.	Description
01300	Oxygen Submittals
01400	Oxygen Quality Control
01650	Oxygen Equipment Installation

Division 11

Section No.	Description
11211-A	Oxygen System
11211-B	Liquid Oxygen Supply

Division 16

Section No.	Description
16010	Electrical General Requirements

Division 17

Section No.	Description
17010	Instrumentation And Control General Requirements
17015	Scope of Instrumentation And Control Work
17110	Enclosures
17124	Instrumentation Cable
17212	Transmitters and Indicators

E1.2 The Contractor is reminded that requests for approval of substitutes as an approved equal or an approved alternative shall be made in accordance with B6.

E1.3 The following Drawings are applicable to the Work:

Consultant Drawing No.	City Drawing No.	Drawing Title
CM G001		Civil – Site Layout
WO-C0100	1-06010-C-C0100-001-00D	Civil – Overall Layout
WO-P0001	1-06010-G-P0001-001-00D	LOX – Liquid Oxygen Storage System No. 1 – Process and Instrumentation Diagram
WO-P0002	1-06010-G-P0002-001-00D	LOX – Liquid Oxygen Storage System No. 2 – Process and Instrumentation Diagram

E2. GOODS

E2.1 The Contractor shall supply LOX and LOX equipment in accordance with the requirements hereinafter specified.

SITE CONDITIONS

E3. SOILS INVESTIGATION REPORT

E3.1 Further to GC.2.01, a copy of the geotechnical information is available on the Winnipeg Water Treatment Program – Project Site Information page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt/projects

E3.2 Test Hole Logs

E3.2.1 Geotechnical information has been compiled from various sources to summarize subsurface conditions within the work area. Test Hole Logs Sets 1 through 3 are available at the aforementioned internet site.

(a) By UMA Engineering

(i) TH's 04-01 to 04-10, 04-12 to 04-24, 04-31, and 04-33 to 04-50 (2004)

(ii) TH's 1 to 3 (1996)

(b) By Others

(i) TH A13 by KGS Group (1991)

(ii) TH's 3 to 6 by RM Hardy & Associates (1977)

(iii) TH 1 and 2 by Dyregrov Consultants (1993)

(c) Within the City of Winnipeg Water Treatment Plant Preliminary Design Report – Section 14 Geotechnical Investigation (2005), UMA Test Hole information is considered accurate at the locations drilled and at the time of the investigations. The inclusion of test hole data recorded by others does not represent any guarantees to the accuracy of this data.

(d) Test hole information is provided to assist in the Bidder's evaluation of subsurface conditions and the Bidder shall solely be responsible for any interpretation that they make from this information. Variations in soil conditions may exist between test holes and fluctuations in groundwater levels can be expected seasonally and may occur as a result of construction activities or operation of the Floodway.

E3.3 Test Pile Driving Records

E3.3.1 Test_Pile_Driving_Records-Set1.pdf at the internet site identified in E3.1 shows data recorded by UMA Engineering Ltd. during driving of ten (10) test piles at the site in March, 2005.

E3.4 Clearwell Pile Driving Records

E3.4.1 166-2005_Clearwell_Pile_Driving_Records.pdf at the internet site identified in E3.1 shows data recorded by Earth Tech Canada Ltd. during the construction of the Clearwell in 2005.

E3.5 Water Treatment Plant Pile Driving Records

E3.5.1 Pile Driving Records for the Water Treatment Plant – Area F are provided at the internet site, identified as Pile_Driving_Records.pdf.

E3.6 Reports

E3.6.1 Additional reports and geotechnical information listed as follows are available for viewing at the offices of Earth Tech Canada Inc., 850 Pembina Highway, Winnipeg, Manitoba.

(a) The City of Winnipeg Water Treatment Plant Preliminary Design Report – Section 14 Geotechnical Investigation (2005)

(b) Water Impounding Reservoir - Cell #2 and Booster Pumping Station Deacon Manitoba by RM Hardy & Associates Ltd. (1977)

(c) Proposed Venturi Chambers Deacon Reservoir by Dyregrov Consultants (1993)

(d) Deacon Reservoir Expansion Proposed Groundwater Monitoring Program by KGS Group (1993)

(e) Shoal Lake Aqueduct Program 5 – Deacon Drainage Improvements by UMA Engineering Ltd. (1996)

(f) Pile Driving records from Deacon Booster Pumping Station by RM Hardy and Associates (1979).

E3.7 Information in these reports has been provided to assist in the Bidder's evaluation of subsurface conditions and the Bidder shall solely be responsible for any interpretation that they make from this information.

E4. OFFICE AND SITE FACILITIES

E4.1 The City will not provide space on Site for Contractor office facilities.

E4.2 With reference to drawing CM G001, the City will provide to the Contractor without cost:

(a) Onsite washroom and toilet facilities with non-potable water supply

E4.3 All power required for construction purposes shall be provided by the Contractor at the Contractor's expense.

E4.4 The Contractor may arrange for additional facilities with the approval of the Contract Administrator and at the Contractor's expense.

E5. SITE ROADS AND WORK SITE ACCESS

E5.1 The Contractor shall have access to the Site on Business Days between 07:00 and 18:00 unless otherwise approved by the Contract Administrator.

E5.2 Access to the work site is restricted and cooperation with other contractors on site is necessary in the best interest of all parties.

E5.3 The Site is located on Provincial Road 207, 3.2 km north of Highway 1 in Dugald, Manitoba.

E5.3.1 The Site address is PR 207, Lot 57082, Dugald, Manitoba.

E5.4 Provincial Road 207 north of the GWWD rail crossing is a Class B1 road and is subject to load restrictions which will affect the maximum weight of individual deliveries. The approximately 3.2 km of PR 207 between the entrance to the Site and Highway 1 is a TAC Route.

E5.5 Access to the Site from the west is generally limited to access via the temporary road from west of the Clearwell and from the south via the temporary road south of the LOX Facility. The access roads will be used by other contractors during the duration of this Contract (maintenance will be shared accordingly) and will remain in place to be utilized by future contracts.

E5.6 Other on site access roads will be installed by others as shown on Drawing CM G001. (Note: The LOX Facility shall be located as shown on WO-C0100).

E5.7 Maintenance and upkeep of the noted roads is the shared responsibility of all contractors who use the roads, including the Contractor.

E5.8 Construction and removal, if necessary, of any additional access roads is the responsibility of this Contractor.

E6. FIELD ENGINEERING

E6.1 Unless otherwise specified, the Contract shall layout the Work.

E6.2 The Contractor shall engage a qualified surveyor to layout the works and record as-constructed measurements for Record Drawings related to the construction of the LOX Facility.

E6.2.1 The surveyor shall be a registered Manitoba Land Surveyor, or an instrumentman or surveying firm experienced in layout of similar projects, subject to the approval of the Contract Administrator.

E6.3 Survey reference points for horizontal and vertical control are indicated on the drawings. The Contractor shall locate, confirm and preserve the reference points during construction.

E7. SANITATION FACILITY

E7.1 Portable toilets may be provided by the Contractor. Any portable toilet shall be cleaned on a weekly basis and provided with regular maintenance as required to ensure proper operation.

E7.2 Portable toilets shall be located in an area acceptable to the Contract Administrator.

E8. WASTE CONTAINER

E8.1 A waste container to dispose of garbage produced from the site shall be provided by the Contractor during the installation of the LOX Facility. It shall be located in a safe, convenient location, and be emptied as necessary by the Contractor. The provision, maintenance and removal of a waste container shall be considered a subsidiary obligation of the Contractor.

E9. CONDITION, PROTECTION OF AND ACCESS TO THE AQUEDUCT

E9.1 Condition of the Aqueduct and Existing Yard Piping

E9.1.1 The Deacon Booster Pumping Station and area contains numerous water conduits of various constructions and vintages. All are critical components of the City of Winnipeg Water Supply and shall be treated with the utmost caution. Work around any of these pipelines shall be well planned and executed to ensure that the Aqueduct and water transmission lines are not subjected to construction related loads, including excessive vibrations and concentrated or asymmetrical lateral loads during backfill placement.

E9.1.2 The Shoal Lake Aqueduct A Section, north of the main access road, between PR 207 and the existing DBPS compound is a 2438 mm diameter cast-in-place reinforced concrete pipe, vintage 1916-1917. The Branch I Aqueduct running east to west, immediately south of the Booster Pumping Station, commencing at the existing main entrance to the station, is constructed of precast reinforced concrete pipe, vintage 1918-1919. The Branch II Aqueduct, running southerly from the surge tower structure, is constructed of AWWA C301 pre-stressed concrete cylinder pipe vintage 1958-1960. Other existing water transmission lines within the Deacon Booster Pumping Station compound and adjacent areas, consist of AWWA C301 pre-stressed concrete cylinder pipe vintage 1970-1995. All of these pipelines have limited capacity to support additional soil cover and live loads beyond their original design condition.

E9.2 Protection of the Aqueducts and Water Transmission Lines

E9.2.1 Contractors carrying out repair work or working in the vicinity of the Aqueducts and transmission lines shall ensure that:

(a) Equipment shall only be permitted to cross the pipes at designated locations. Under no circumstances will equipment be permitted to cross the A section of the Aqueduct other than at bridging structures.

(b) Granular material, construction material, soil or other material shall not be stockpiled on the Aqueduct or within 5 metres of the Aqueduct centerline.

(c) Construction practices shall not subject the Aqueduct to asymmetrical loading at any time.

(d) Construction practices or procedures at or near the Aqueduct shall not impart excessive vibration loads on the Aqueduct and/or cause settlement of the subgrade below the Aqueduct.

(e) Asymmetrical water pressures shall not be permitted to build up on one side of the Aqueduct arch.

(f) Further to CW 2030-R6, only smooth edged excavation buckets, soft excavation or hand excavation shall be used for excavation adjacent to and over the pipelines.

E9.2.2 It is the Contractors' responsibility to ensure that all work crew members understand, observe, and work to the requirements of Specifications.

E9.3 Equipment Restrictions

E9.3.1 Equipment must cross the Aqueduct in a responsible and careful manner (i.e. slowly).

E9.3.2 Loads for Highway No. 207 shall be limited to the weight restrictions in place for the road unless otherwise permitted.

E10. ENVIRONMENTAL PROTECTION

E10.1 The Contractor shall be aware that the Aqueduct is for potable water supply and no contamination by fuel, chemicals, etc. shall be permitted at any time. Fuels or chemicals shall not be stored within thirty (30) metres of the Aqueduct.

E10.2 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the environmental protection measures as herein specified.

E10.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E10.3.1 Federal

(a) Canadian Environmental Protection Act (CEPA) c.16

(b) Transportation of Dangerous Goods Act and Regulations c.34

E10.3.2 Provincial

(a) The Dangerous Goods Handling and Transportation Act D12

(b) The Endangered Species Act E111

(c) The Environment Act c.E125

(d) The Fire Prevention Act F80

(e) The Manitoba Nuisance Act N120

(f) The Public Health Act c.P210

(g) The Workplace Safety and Health Act W120

(h) Current applicable associated regulations.

(i) The Fisheries Act

(j) The Migratory Birds Act

(k) The Historic Resources Act

(l) Drinking Water Safety Act

E10.3.3 The Contractor is advised that the following environmental protection measures apply to the Work.

E10.3.4 Materials Handling and Storage

(a) Construction materials shall not be stored within ten (10) metres of the Aqueduct centerline without the approval of the Contract Administrator.

E10.3.5 Fuel Handling and Storage

(a) The Contractor shall abide by the requirements of Manitoba Conservation storage and handling of Petroleum Products and Allied Products Regulations for handling and storage of fuel products.

(b) All fuel handling and storage facilities shall comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.

(c) Fuels, lubricants, and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act shall be stored and handled within the approved storage areas.

(d) The Contractor shall ensure that all fuel storage containers are inspected daily for leaks and spillage.

(e) Products transferred from the fuel storage area(s) to specific work sites shall not exceed the daily usage requirement.

(f) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill. No repairs within thirty (30) metres of aqueduct or watercourse will be permitted.

(g) Refuelling of mobile equipment and vehicles shall take place at least thirty (30) metres from a watercourse.

(h) The area around storage sites and fuel lines shall be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.

(i) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills shall be stored nearby on-site. The Contractor shall ensure that additional material can be made available on short notice. All refuelling vehicles shall be equipped with a spill response kit.

E10.3.6 Waste Handling and Disposal

(a) The construction area shall be kept clean and orderly at all times during and at completion of construction.

(b) At no time during construction shall personal or construction waste be permitted to accumulate for more than one day at any location on the construction site, other than at a dedicated storage area as may be approved by the Contract Administrator.

(c) Indiscriminate dumping, littering, or abandonment shall not take place.

(d) No on-site burning of waste is permitted.

(e) Equipment shall not be cleaned within thirty (30) metres of watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

E10.3.7 Dangerous Goods/Hazardous Waste Handling and Disposal

(a) Dangerous goods/hazardous waste are identified by, and shall be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.

(b) The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations and meet training requirements for these Regulations.

E10.3.8 Emergency Spill Response

(a) The Contractor shall ensure that due care and caution is taken to prevent spills.

(b) The Contractor shall report all major spills of petroleum products or other hazardous substances with the potential for impacting the environment and threat to human health and safety to the Contract Administrator and Manitoba Conservation, immediately after occurrence of the environmental accident, by calling the 24-hour emergency telephone phone number (204) 945-4888.

(c) The Contractor shall designate a qualified supervisor as the on-site emergency response coordinator for the project. The emergency response coordinator shall have the authority to redirect manpower in order to respond in the event of a spill. (Should include reference to a site-specific Emergency Response Plan and Environmental Protection Plan.)

(d) The following actions shall be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on-site emergency response coordinator:

(i) Notify emergency-response coordinator of the accident:

- identify exact location and time of accident
- indicate injuries, if any
- request assistance as required by magnitude of accident Manitoba Conservation 24-hour Spill Response Line (204) 945-4888, RCMP (Oakbank Detachment) (911), City of Winnipeg Fire Department (911), Springfield Ambulance (911), company backup, contact Contract Administrator.

(ii) Assess situation and gather information on the status of the situation, noting:

- personnel on site
- cause and effect of spill
- estimated extent of damage
- amount and type of material involved
- proximity to waterways and the Aqueduct

(iii) If safe to do so, try to stop the dispersion or flow of spill material:

- approach from upwind
- stop or reduce leak if safe to do so
- dyke spill material with dry, inert sorbent material or dry clay soil or sand
- prevent spill material from entering waterways and utilities by dyking
- prevent spill material from entering Aqueduct manholes and other openings by covering with rubber spill mats or dyking

(iv) Resume any effective action to contain, clean up, or stop the flow of the spilled product.

E10.4 The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to the Manitoba Conservation according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

E11. SITE RESTORATION

E11.1 The Contractor shall remove the temporary Site office and storage facilities prior to Total Performance.

E11.2 The Contractor will be responsible for grounds restoration, as determined necessary by the Contract Administrator.

E11.3 The Contractor will be responsible for any damage caused by his forces on roadways or accesses.

E12. RECORD DRAWINGS

E12.1 The Contractor shall keep one (1) complete set of white prints at their Site office, including all Addenda, Change Orders, Field Instructions, and other revisions for the purposes of Record Drawings. As the Work proceeds, the Contractor shall clearly record in red pencil all as-built conditions which deviate from the original Contract documents.

E12.2 The Record Drawings shall be available for review by the Contract Administrator upon request at any time during the performance of the Work.

E12.3 Prior to achieving Substantial Performance, the Contractor shall submit the Record Drawings prepared to the Contract Administrator for his review and use. If, in the opinion of the Contract Administrator, the Record Drawings are incomplete or inaccurate, the Record Drawings will be returned to the Contractor and the Contractor shall revise and resubmit the Record Drawings at his cost.

E12.4 Substantial Performance cannot be achieved without the submission of Record Drawings that are acceptable to the Contract Administrator.

OXYGEN SUBMITTALS

1. SHOP DRAWINGS

1.1 General

.1 Arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator of any deviations in Shop Drawings from the requirements of the Contract Documents to allow the Contract Administrator to assess the deviations.

.2 Where all or part of the Shop Drawings are to be prepared under the stamp and seal of a Professional Engineer registered in the Province of Manitoba, the Contract Administrator will limit that review to an assessment of the completeness of the part of the submission so stamped and sealed.

1.2 Electrical and Controls Installation Information

.1 Key information will be taken from Shop Drawings to prepare electrical and instrumentation Drawings and/or layout Drawings, control schematics, and interconnection wiring diagrams.

1.3 Submission Requirements

.1 Coordinate each submission with requirements of the Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

.2 Accompany submissions with a transmittal letter, in duplicate, containing:

.1 Date.

.2 Project title and Bid Opportunity number.

.3 Contractor's name and address.

.4 Specification Section number for each submittal.

.5 Submittal number and revision number in the following format:

.1 135 - Spec Section # - Submittal # - Revision # (e.g. 135-15200-001-1).

.6 Identification and quantity of each Shop Drawing product.

.7 Equipment tag number.

.8 Other pertinent data.

.3 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Contractor.

.2 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 As required in the specifications, the seal and signature of a Professional Engineer registered in the Province of Manitoba.

.4 Details of appropriate portions of work as applicable:

.1 Fabrication.

.2 Layout showing dimensions including identified field dimensions and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Method of control of equipment and its communication with the City’s SCADA system.

1.4 Drawings

.1 Original Drawings or modified standard Drawings provided by the Contractor to illustrate details of portions of Work which are specific to project requirements.

.2 Maximum sheet size: 850 x 1050 mm.

OXYGEN SUBMITTALS

.3 Submit seven (7) prints and one (1) reproducible copy of Shop Drawings. The Contract Administrator will return the reproducible copy with comments transcribed.

.4 Cross-reference Shop Drawing information to applicable portions of the Contract Documents.

1.5 Product Data

.1 Product Data; Manufacturer's catalogue sheets, brochures, literature, performance charts, and diagrams used to illustrate standard manufactured products.

.2 Submit twelve (12) copies of product data.

.3 Sheet size: 215 x 280 mm.

1.6 Procedure and Routing

.1 The Contractor shall provide to the Contract Administrator thirteen (13) printed copies of the Shop Drawings and corresponding submittal transmittal form(s) complete with the information specified in 1.3 Submission Requirements.

.2 The Contractor shall simultaneously email the .pdf version of these same Shop Drawings and submittal transmittal forms to the Contract Administrator. The Contractor shall ensure the .pdf version of the Shop Drawings and corresponding submittal transmittal form(s) are identical to the printed copies being distributed for review. When the total size of the email is greater than 5 MB, the Contractor shall post the .pdf version of the Shop Drawings and submittal transmittal form(s) to an accessible place on the internet (provided by the Contract Administrator) and an e-mail notification is to be sent to all parties listed above when posting is complete.

.3 The routing and the names of individuals responsible for receiving submittals will be identified by the Contract Administrator at the pre-construction meeting held pursuant to D4.2.

.4 Upon review of the Shop Drawings, the Contract Administrator will e-mail the .pdf version of the annotated Shop Drawings and corresponding transmittal form(s) to the Contractor. When the total size of the email is greater than 5 MB, the Contract Administrator will post the .pdf version of the Shop Drawings and corresponding transmittal form(s) to the same accessible place on the internet and an e-mail notification will be sent to the Contractor. Two (2) printed copies of the reviewed Shop Drawings will be sent back to the Contractor.

1.7 Shop Drawing Review

.1 Shop Drawing review by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for the approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.

.2 Review by the Contract Administrator shall not relieve the Contractor of his responsibility for errors or omissions in Shop Drawings or for proper completion of the Work in accordance with the Contract Documents.

.3 Shop Drawings will be returned to the Contractor with one of the following notations:

.1 When stamped "REVIEWED", distribute additional copies as required for execution of the Work.

.2 When stamped "REVIEWED AS MODIFIED", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".

.3 When stamped "REVISE AND RE-SUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.

.4 When stamped "NOT REVIEWED", submit other drawings, brochures, etc., for review consistent with the Contract Documents.

.5 Only Shop Drawings bearing "REVIEWED" or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.

.4 After submittals are stamped "REVIEWED" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.

.5 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.

.6 Make changes in Shop Drawings which the Contract Administrator may require consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

.7 Shop Drawings indicating design requirements not included in the Contract Documents require the seal of a Professional Engineer, registered in the Province of Manitoba. If requested, submit engineering calculations for review, sealed by a Professional Engineer.

1.8 Operating and Maintenance Manuals

.1 N/A

END OF SECTION

OXYGEN QUALITY CONTROL

1. CODES AND STANDARDS

.1 In the case of a conflict or discrepancy between the Contract Documents and the governing standards, the more stringent requirements shall apply.

.2 Unless the edition number and date are specified, the reference to the Manufacturer's and published codes, standards, and specifications are to be the latest edition published by the issuing authority, current at the date of Submission Deadline.

.3 Reference standards and specifications are quoted in this Specification to establish minimum standards. Work in quality exceeding these minimum standards conforms to the Contract.

.4 Where reference is made to a Manufacturer's direction, instruction, or specification, it is deemed to include full information on storing, handling, preparing, mixing, installing, erecting, applying, or other matters concerning the products pertinent to their use and their relationship to the products with which they are incorporated.

.5 Confine apparatus, the storage of products, and the operations of workers to limits indicated by laws, ordinances, permits, and by directions of the Contract Administrator. Do not unreasonably encumber the premises with products.

.6 Where reference is made to regulatory authorities, it includes all authorities who have, within their constituted powers, the right to enforce the laws of the place of work.

2. TESTING AND QUALITY CONTROL

.1 Provide to the Contract Administrator, when requested and consistent with progress of the Work, test results and designs specified in the Contract Documents or required by by-laws, statutes, and regulations relating to the Work and the preservation of public health, including the following:

.1 Inspection and testing performed exclusively for the Contractor's convenience;

.2 Testing, adjusting, and balancing of process equipment and systems, conveying equipment and systems, mechanical, electrical, and I&C equipment and systems;

.3 Mill tests and certificates of compliance;

.4 Tests for reinforcing steel unidentified by mill test reports.

.2 The Contract Administrator will select and the City will pay for the services of a testing agency or laboratory for material quality control tests that are required but not specified. Tests required by by-laws, statutes, and regulations applicable to the Work are the responsibility of the Contractor.

.3 Compliance and performance testing of equipment, pipe, conduit, wiring, and other items covered in other Divisions of this Specification are the responsibility of the Contractor, unless specified otherwise. The City may replicate any series of tests to provide random checks on the compliance and performance tests at the City's cost.

.4 Remove and replace products indicated in inspection and test reports as failing to comply with the Contract Documents.

.5 Correct improper installation procedures reported in the inspection and test reports.

.6 Pay the costs for the re-inspection and re-testing of replaced Work.

.7 It is not the responsibility of the inspection and testing agents to supervise, instruct in current methods or accept or reject a part of the Work, but only to inspect, test, and to report conditions.

.8 Notify the Contract Administrator and the appropriate inspection and testing agent not less than forty-eight (48) hours prior to the commencement of the part of the Work to be inspected and tested.

.9 Ensure the presence of the authorized inspection and testing agent at the commencement of the part of the Work specified to be inspected or tested.

.10 Ensure the inspection and testing reports are issued within forty-eight (48) hours, and that the Contract Administrator is notified forthwith if the report indicates improper conditions or procedures.

.11 Cooperate with and provide facilities for the inspection and testing agents to perform their duties.

.12 Provide proper facilities for the storage of specimens or samples at correct temperature, free from vibration or damage in accordance with the instruction of the inspection and testing agent and the governing standard.

.13 Submit four (4) copies of each laboratory test report, unless specified otherwise, each copy signed by a responsible officer of the inspection and testing laboratory. Each report is to include:

.1 Date of issue.

.2 Contract name and number.

.3 Name and address of inspection and testing company.

.4 Name and signature of inspector or tester.

.5 Date of inspection or test.

.6 Identification of the product and specification section covering inspected or tested Work.

.7 Location of the inspection or the location from which the tested product was derived.

.8 Type of the inspection or test.

.9 The remarks and observations on compliance with the Contract Documents.

.14 Correct defective Work within the Contract Time; the performing of such Work is not a cause for an extension of the Contract Time.

END OF SECTION

OXYGEN EQUIPMENT INSTALLATION

1. INTENT

.1 This Section describes general requirements for all equipment supplied under the Contract relating to the supervision of installation, testing, operation, and Performance Verification. The Contractor shall be responsible for the installation work, testing, operation, and Performance Verification of equipment in this Contract.

2. EXPERTISE AND RESPONSIBILITY

.1 The Contract Administrator recognizes the expertise of the Manufacturer.

.2 Should the Contract Administrator issue an Addendum, Field Order, Change Order, or Instruction to change the Work which would, in the opinion of the Contractor, compromise the success or safety of the Work, then it shall be incumbent on the Contractor to notify in writing the Contract Administrator to this effect within two (2) business days.

3. EQUIPMENT DELIVERY

.1 The Contractor shall be responsible for equipment delivery to the Site. When the Contractor accepts the equipment delivery, he shall certify the delivery by completing Form 100 – Certificate of Equipment Delivery, attached to this Specification.

.2 Ten (10) business days before delivery, notice shall be given to the Contract Administrator so that arrangements for receipt and for inspection can be made. The shipping lists of materials will be carefully checked by the Manufacturers Representative in the presence of the Contract Administrator and the Contractor.

.3 The Contractor shall be responsible for all equipment at the Site or any alternative storage location.

.4 The Contractor shall ensure that he is fully informed of precautions to be taken in the unloading of equipment and its subsequent storage including any required maintenance.

.5 If equipment off-site storage is required, then the second move of the equipment to the Site will be at the Contractor’s cost.

4. INSTALLATION ASSISTANCE

.1 Before commencing installation of equipment, the Contractor shall arrange for the attendance of the Manufacturer's Representative to provide instructions in the methods, techniques, precautions, and any other information relevant to the successful installation of the equipment.

.2 The Contractor shall inform the Contract Administrator, in writing, of the attendance at the site of any Manufacturer's Representative for installation training at least fourteen (14) days prior to arrival.

.3 When the Manufacturer's Representative is satisfied that the Contractor is aware of all installation requirements, he shall so certify by completing Form 101 – Certificate of Readiness to Install attached to this specification.

.4 The completed form shall be delivered to the Contract Administrator prior to departure of the Manufacturer's Representative from the Site.

.5 Installation of the equipment shall not commence until Contract Administrator has advised that he has received the completed Form 101.

.6 Separate copies of Form 101 shall be used for different equipment.

5. INSTALLATION

.1 If necessary, or if so directed by the Contract Administrator during the course of installation, the Contractor shall contact the Manufacturer’s Representative to receive clarification of installation procedures, direction, or any other additional information necessary to continue or complete the installation in an appropriate manner.

.2 If it is found necessary, or if so directed by the Contract Administrator, the Contractor shall arrange for the Manufacturer's Representative to visit the site to provide assistance during installation, all at the Contractor’s cost.

.3 Prior to completing installation, the Contractor shall inform the Manufacturer’s Representative and arrange for the attendance at the site of the Manufacturer's Representative to verify successful installation.

.4 The Manufacturer’s Representative shall conduct a detailed inspection of the installation including alignment, electrical connections, belt tensions, rotation direction, running clearances, lubrication, workmanship and all other items as required to ensure successful operation of the equipment.

.5 The Manufacturer’s Representative shall identify any outstanding deficiencies in the installation.

.6 The deficiencies shall be rectified by the Contractor and the Manufacturer’s Representative will be required to re-inspect the installation, at the Contractor’s cost.

.7 When the Manufacturer’s Representative accepts the installation, he shall certify the installation by completing Form 102 – Certificate of Satisfactory Installation, attached to this specification.

.8 Deliver the completed Form 102 to the Contract Administrator prior to departure of the Manufacturer's Representative from the site.

.9 Tag the equipment with a 100 mm x 200 mm card stating “Equipment Checked. Do Not Run.” stenciled in large black letters. Sign and date each card.

.10 Provide separate copies of Form 102 for different equipment.

6. OPERATION AND PERFORMANCE VERIFICATION

.1 Equipment will be subjected to a demonstration, running test, and performance test after the installation has been verified and any identified deficiencies have been remedied.

.2 During the demonstration, running tests, and performance tests, the Contractor shall operate equipment as required to complete the Performance Verification required from all Divisions of this Specification.

.3 Inform the Contract Administrator at least fourteen (14) calendar days in advance of conducting the tests and arrange for the attendance of the Manufacturer’s Representative. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contractor and the Contract Administrator.

.4 The Manufacturer’s Representative shall conduct all necessary checks to equipment and if necessary, advise the Contractor of any further checking, flushing, cleaning, or other work needed prior to confirming the equipment is ready to run.

.5 The Contractor shall then operate the equipment for at least one (1) hour to demonstrate to himself the operation of the equipment and any required ancillary services. Any remedial measures required to ensure satisfactory operation shall be promptly undertaken.

.6 Demonstration:

.1 The Contractor shall then notify the Contract Administrator of his readiness to demonstrate the operation of the equipment. The Contract Administrator shall attend, as expeditiously as possible.

.2 With the assistance of the Manufacturer’s Representative, the Contractor shall demonstrate that the equipment is properly installed. Alignment, piping connections, electrical connections, etc. will be checked and if appropriate, code certifications provided.

.3 The equipment shall then be run for one (1) hour. Local controls shall be satisfactorily verified by cycling the equipment through several start-stop operations, modulating its output, or some combination. Operating parameters such as temperature, pressure, voltage, vibration, etc., will be checked to ensure that they are within the specified or Manufacturer's Representative’s recommended limits, whichever is more stringent.

.4 On satisfactory completion of the one (1) hour demonstration, the equipment shall be stopped and critical parameters, such as alignment, shall be rechecked.

.7 Running Test:

.1 The equipment shall be restarted and run continuously for a minimum of three (3) days (72 hours) or as specified. During this period, as practicable, conditions shall be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the Manufacturer's Representative, the Contractor, and Contract Administrator on the basis of the information contained in the technical specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.

.8 Performance Tests:

.1 Performance tests shall be conducted either concurrent with or subsequent to the running test, as practicable and agreed between the Contract Administrator, the Manufacturer's Representative, and the Contractor.

.2 The equipment shall be run continuously for a minimum of seven (7) days (168 hours) or as specified.

.3 Performance tests shall be as dictated in the technical specifications for each item of equipment or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the specification.

.4 The Contractor shall submit the results of the performance tests within 24 hours to the Contract Administrator, and final documented and summarized results in a format acceptable to the Contract Administrator within seven (7) calendar days. The Contract Administrator reserves the right to request additional testing. No equipment shall be accepted prior to the satisfactory completion of the performance test(s) and receipt of the test reports.

.9 All water, chemicals, oxygen, permanent power (except portable generators) required to complete the initial demonstration, running test and performance tests are the responsibility of the City. The Contractor will provide the oxygen and other chemicals required and the City will pay for them at the unit rate.

.10 Should the initial demonstration, running test or performance tests reveal any defects, then those defects shall be promptly rectified and the demonstration, running tests, and/or performance tests shall be repeated to the satisfaction of the Contract Administrator. Additional costs incurred by the Contractor, the Contract Administrator, or the City, due to repeat demonstration, running tests, and/or performance tests shall be the responsibility of the Contractor.

.11 On successful completion of the demonstration, running test, and performance tests, Form 103 – Certificate of Equipment Satisfactory Performance attached to this Specification will

be signed by the Manufacturer's Representative, the Contractor, and the Contract Administrator.

.12 The Contractor shall affix to the tested equipment a 100 mm x 200 mm card reading "Operable Condition - Do Not Operate without Contractor's Permission." stenciled on in large black letters.

CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100

We certify that the equipment listed below has been received and delivered into the care of the Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
(Authorized Signing Representative of the Contractor) Date

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

_____ _____
(Authorized Signing Representative of the Contract Administrator) Date

OXYGEN EQUIPMENT INSTALLATION

CERTIFICATE OF READINESS TO INSTALL
FORM 101

I have familiarized the Contractor of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

I certify that I have received satisfactory installation instructions from the equipment Manufacturer/ Supplier.

_____ _____
(Authorized Signing Representative of the Contractor) Date

OXYGEN EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY INSTALLATION
FORM 102

I have completed my check and inspection of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

_____ _____

(Authorized Signing Representative of the Manufacturer) Date

_____ _____

(Authorized Signing Representative of the Contractor) Date

_____ _____

(Authorized Signing Representative of the Contract Administrator) Date

CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least seven (7) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

_____ _____
(Authorized Signing Representative of the Contractor) Date

_____ _____
(Authorized Signing Representative of the Contract Administrator) Date

END OF SECTION

OXYGEN SYSTEM

1. GENERAL

.1 The Contractor shall furnish a LOX based, oxygen gas system to provide a continuous stream of oxygen gas to ozone generation equipment employed in the production of potable water.

1.2 Work Included

.1 The Contractor shall be responsible for the design, supply, installation, and operation of the oxygen system specified herein. The system shall include, but not be limited to, the following:

.1 LOX storage tanks.

.2 Ambient vapourizers.

.3 Electric trim heater

.4 Pressure regulating assembly.

.5 System shutoff valves.

.2 The Contractor shall be responsible for coordination, proper sizing, and performance of all oxygen system piping and components.

.3 Operate and maintain the equipment supplied under this Contract during the validity of the agreed contract term.

.4 Provide safety, emergency and basic system operation training to City personnel.

.5 Start up and commissioning of the oxygen system.

1.3 Work Not Included

.1 All external gas piping between the oxygen system and the ozone system, as outlined in the Drawings.

.2 Particulate filters.

.3 Nitrogen Boost Unit.

.4 The concrete pad, fencing, gate, and roadway.

.5 Electrical power (600 V) to the oxygen system electrical box.

1.4 References

.1 The following is a list of standards and regulatory bodies which may be referenced in this Section:

.1 CGA: Pamphlet G-4.1, “Cleaning Equipment for Oxygen Service”.

.2 NFPA.

.3 ASME Pressure Vessel Code, Section VIII, Division 1

.4 ASME Pressure Vessel Code, Section II, Part A

.5 Technical Standards and Safety Authority (TSSA)

1.5 Submittals

.1 General:

.1 Submittals shall be made as required in Section 01300 – Submittals.

.2 Shop Drawings: The following Shop Drawings shall be submitted for this equipment:

.1 Itemized bill-of-materials listing for all components, including spare parts and special tools.

.2 Make, model, weight, and power requirements of each equipment assembly.

.3 Dimensions of area required for servicing equipment.

.4 Performance data.

.5 Detailed structural, mechanical, and electrical drawings showing the equipment dimensions, size, locations of connections, and weights of equipment.

.6 Detailed arrangement drawings for all equipment indicating location and dimension on the concrete pad, see drawings for dimensions and proposed equipment locations.

.7 External utility requirements such as power and drains for each component.

.8 Complete motor nameplates data, as defined by NEMA, motor, Manufacturer, and including any motor modifications.

.9 Rated capacity of each component under the specified operating conditions.

.10 Color cards, the name of the paint Manufacturer, and complete descriptive Specifications for the proposed paint system. Colors will be selected by the City.

.3 Quality Control Submittals:

.1 Meet quality control submittals as specified under Section 01400 – Oxygen Quality Control, as well as provide the following:

.1 Certification of Equipment Delivery in accordance with Section 01650 – Oxygen Equipment Installation.

.2 Certification of Readiness to Install in accordance with Section 01650 – Oxygen Equipment Installation.

.3 Certification of Satisfactory Installation in accordance with Section 01650 – Oxygen Equipment Installation.

.4 Manufacturer's Certification of Satisfactory Equipment Performance in accordance with Section 01650 – Oxygen Equipment Installation.

.5 Certification of Satisfactory Training in accordance with Section 01650 – Oxygen Equipment Installation

.6 Manufacturer's service reports during equipment fabrication.

.7 Special shipping, storage and protection, and handling instructions.

.8 Submit seven (7) certified copies of the test results for each Factory Test to the Contract Administrator for review and acceptance. Each equipment item will not be shipped until the Contract Administrator has reviewed and accepted the Test results and advised the Contractor that the equipment is acceptable for shipping. Include in the Test reports the date of the Test, the Test equipment utilized, a list of all instrumentation and calibration data, Test data presented in tabular form, list of all discrepancies and the corrective actions, and a summary of the Test results.

1.6 Design Criteria

.1 The oxygen system shall provide a continuous stream of gaseous oxygen that has been fully vapourized from LOX. The gas is to be used for ozone generation; therefore it must be conditioned to eliminate moisture. Gas temperature and pressure must also be regulated prior to use in the ozone generating equipment.

.2 The WTP will use oxygen 24 hours a day, seven days a week to produce ozone. Uninterrupted oxygen supply is essential for the operation of the Plant. The Contractor shall design the oxygen system to minimize the system's down time to a maximum of 24 hrs.

.3 The oxygen system shall be designed and installed in accordance with NFPA 50, TSSA, and ASME requirements and industry standards as set forth by the CGA.

.4 The system shall be designed to meet all service criteria listed in the table below:

	Usage	Season	Duration of Demand	Ambient Temperature Range (ºC)	
LOX Consumption	**(kg/d)**		**(days)**	**Minimum**	**Maximum**
Maximum	18300	**Summer** (June, July, and August)	14	-3	40
Average	3860	**All seasons**	90	-45	40
Minimum	415	**Winter** (December, January, February)	30	-45	12

.5 Minimum acceptable GOX temperature: - 46ºC

.6 Location: Dugald, Manitoba, Canada. See drawings for specific LOX facility location.

.7 Exposure: Outdoors, no shading.

.8 Elevation: 236.5 m above mean sea level.

2. PRODUCTS

2.1 General

.1 The equipment supplied and installed under this section shall meet the overall system requirements and performance guarantees specified in Section 01650 – Oxygen Equipment Installation.

.2 The equipment furnished under this section shall fit within the space provided on the LOX equipment pad shown in the drawings.

.3 The equipment specified herein shall be fabricated, shop-tested, and fully assembled units requiring a minimum of field installation labour.

.4 Design the equipment specified herein as required by applicable standards, good industrial practice, laws, regulations and specified performance.

.5 Piping, tanks and equipment shall be protected with suitable pressure relief valves as required to prevent excessive pressure build-up due to trapped LOX or vapour.

.6 All components and materials of construction shall be suitable for the intended service. All parts in contact with oxygen gas (i.e. downstream of the vapourizers) shall be Type 316L stainless steel. For welded assembly use Type 316L stainless steel. Copper piping and fittings shall be installed upstream of the vapourizers.

.7 Where applicable, materials shall be compatible with cryogenic liquid use.

.8 Furnish the oxygen system as a complete unit that includes, but is not limited to, the following items:

.1 Two (2) LOX storage tanks with required pressure and level regulating systems which would include, but not be limited to: safety valves, pressure gauges, ambient vapourizers and level meters.

.2 Minimum two (2) vapourizer assemblies

.3 Two (2) trim heaters

.4 System shut off valves.

.5 Two (2), pressure regulating valves in parallel with manual isolation.

.6 Automatic switchover unit for the vapourizer assemblies.

.7 All required labels and signs.

.8 All interconnecting piping, valves, supports, within the concrete oxygen system pad area.

.9 Electrical power and control connections between the control panel and the various components with the concrete pad area.

.10 Safety signage.

.11 Dedicated telemetry system for LOX remote tank level monitoring.

.12 Repeat tank level signals (4 to 20 ma) to site SCADA system

2.2 LOX Tank

.1 Two (2) vertical, cylindrical, double walled, cryogenic tanks with vacuum perlite insulation.

.2 The nominal capacity of each tank shall be 42,000 L (11,000 gal) minimum.

.3 Design standards:

.1 Design, fabricate, test, inspect, stamp per ASME Pressure Vessel Code, Section VIII, Division 1. Rated 862 kPa (125 PSIG) or higher

.2 Material of construction per ASME Section II, Subsection A, and may be SA-353 or SA-553 Type I, 9 percent nickel steel

.3 NFPA 50

.4 Industry standards as set forth by the CGA.

.5 Tank/piping shall be registered with TSSA. The Contractor shall provide copies of applicable certificates.

.4 Construct the outer vessel of carbon steel suitably prepped and primed before applying a final paint system.

.5 Design the outer vessel for full vacuum internal, with a safety factor of not less than two.

.6 Provide the following piping systems with labels, as a minimum:

.1 Top and bottom tank fill lines

.2 Safety relief line for inner vessel

.3 Top and bottom gauge lines for pressure and level indication

.4 Full trycock line

.5 Liquid product withdrawal line

.6 Economizer return line

.7 Pressure building coil line

.8 Insulation space evacuation and gauge line

.7 Provide a tank fill system complete with a standard CGA oxygen hose connector, check valve, pressure relief valve, and drain valve.

.8 Provide the inner and outer vessels and the piping systems with safety valves and rupture disks to protect the equipment from excessive pressure.

.9 Provide the tank with liquid level indication in metric units, low and high level alarm signals; provide isolation valves for all required instrumentation.

.10 Furnish the tank with all safety devices, appurtenances, and equipment required for operation.

2.3 Vapourizer Assemblies

.1 Size each vapourizer to meet projected oxygen consumption in accordance with Subsection 1.6.4.

.2 Internal tubing shall be Aluminum with wide gap aluminum fins to reduce ice bridging.

.3 Provide ambient vapourizers complete with piping connections and support legs suitable for anchor bolt attachment to an equipment pad.

.4 Provide a cycling timer to set the cycle time for switching lead vapourizers using automated switchover valves. This cycle should be adjustable between 12 and 24 hours.

2.4 Electric Trim Heater

.1 Two (2) trim heaters in parallel with manual isolation valves shall be mounted downstream of the vapourizer assemblies.

.2 Minimum gas outlet temperature from trim heater: 5°C.

.3 Unit will include at least the following equipment:

.1 NEMA 4 electrical enclosure.

.2 Circuit breaker type disconnect.

.3 Insulated casting assembly.

.4 A power contactor used in conjunction with the high temp limit to shut off the heater if the casting overheats. High temperature limit set at 205°C.

.5 A power contactor for applying power to heaters.

.6 Control circuit transformer, control circuit fuse, control circuit ON/OFF switch, power on light, and heater on light.

.7 Air temperature sensor to control the trim heater and valve sequence. The unit shall turn on and start heating the gas once the ambient air temperature drops below 10°C.

.8 The system power shall be rated at 600 VAC, three-phase, 60 Hz.

2.5 Pressure Regulating Assembly:

.1 A pressure regulating station shall reduce pressure to between 276 and 485 kPa (40 and 70 PSI), the final set point shall be field adjustable. Pressure shall not deviate from final set point more than 14 kPa (2 psi) up or down.

.2 The Pressure regulating station shall include, as minimum, two pressure regulating valves placed in parallel, flow piping, pressure gauges with isolation valves. Each pressure regulating assembly shall cover the full gas flow range.

.3 Unit shall include at least the following:

.1 Bronze pressure regulator.

.2 Stainless steel interconnecting piping.

.3 Inlet pressure gauge.

2.6 System Shutoff Valve

.1 Provide both electrically actuated and manual isolation valves. The actuated shutoff valve shall automatically close when an alarm condition is raised by the plant control system. Alarm condition will override the operator's ability to choose the valve condition (OPEN/CLOSED). Provide a manual bypass around the system shutoff valve, with manual isolation on both sides of the shutoff valve as shown in the drawings, in order to facilitate maintenance on the shutoff valve, when required.

.2 The system shutoff assembly will be located on the oxygen system pad.

2.7 Valves

.1 All valves required for proper control and operation shall be supplied as part of the oxygen system and shall be suitable for oxygen and cryogenic service where applicable.

.2 All valves shall be rated for 150 psig working pressure

.3 Pressure safety valves shall be placed between every system isolation point, sized to vent system flow, and set to protect the system equipment, tanks and piping from excessive pressure build-up due to trapped liquid oxygen, as well as additional locations as shown in the Drawings. The exhaust from these valves should be directed downward for safety reasons.

.4 Provide a pressure relief valve downstream of the pressure regulating assembly.

.5 Provide isolation valves for all online instruments.

.6 Provide automated isolation valves downstream of each vapourizer.

.7 Provide a manual valve upstream of each vapourizer.

2.8 Instrumentation and Control

.1 The oxygen system shall include all required instrumentation for monitoring of the tank level and pressure of the oxygen in the storage tank, pressure upstream and downstream of all pressure regulating valves.

2.9 Connection to the WTP SCADA System

.1 Provide the following signals to the WTP SCADA System for control and monitoring purposes:

.1 Level

.2 Master oxygen shut off valve position and control

.2 Allow for emergency system shut down signals from the plant control system to initiate closure of the master oxygen shutoff valve.

2.10 Accessories

.1 Anchor Bolts: Supply and install stainless steel anchor bolts for equipment mounting.

.2 Identification Plates: Mount 16-gauge stainless steel plates in readily visible locations on each separate component of equipment.

.3 Lifting Lugs: Provide on equipment and equipment components over 45 kg.

2.11 Spare Parts

.1 Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance.

.2 Maintain a local inventory of spare parts as required to limit equipment down time to 24 hours.

3. EXECUTION

3.1 General:

.1 The Contractor shall ensure the completeness of the installation according to the industry standards and applicable codes and regulations.

3.2 Installation

.1 The oxygen system equipment shall be installed in accordance with Manufacturer's Recommendations.

3.3 Cleaning

.1 Piping, valving, and all other equipment in oxygen and ozone gas service supplied and installed under this section shall be cleaned in compliance with the CGA Pamphlet G4.1, "Cleaning Equipment for Oxygen Service," latest edition and shall be of suitable materials for the appropriate service.

3.4 Manufacturer's Services

.1 See Section 01650 – Oxygen Equipment Installation for required Manufacturer's services.

END OF SECTION

LIQUID OXYGEN SUPPLY

1. GENERAL

1.1 Work Included

.1 The Contractor shall be responsible for supplying the LOX specified herein.

.2 Initial fill of the LOX storage tanks for system operation.

.3 The Contractor shall be responsible for coordination, proper sizing, and performance of all delivery connections and fittings both on the pad and the delivery vehicle.

.4 Supply of LOX during the validity of the agreed contract term.

1.2 References

.1 The following is a list of standards and regulatory bodies which may be referenced in this Section:

.1 ANSI/AWWA B304-05 “Oxygen for Ozone Generation”.

.2 NSF

.3 CGA Pamphlet G4.1, “Cleaning Equipment for Oxygen Service,”

1.3 Submittals

.1 General:

.1 Submittals shall be made as required in Section 01300 – Submittals.

.2 The following shall be provided:

.1 Material Safety Data Sheets (MSDS).

.2 Other data as required to verify all specified requirements.

.3 Quality Control Submittals:

.1 Special shipping, storage and protection, and handling instructions.

1.4 Design Criteria

.1 The WTP will use oxygen 24 hours a day, seven days a week to produce ozone. Uninterrupted oxygen supply is essential of the operation of the WTP. The Contractor shall develop a delivery and monitoring program that will ensure that there is no interruption in the availability of LOX.

.2 Location: Winnipeg, Manitoba, Canada. See drawings for specific site location.

.3 Exposure: Outdoors, no shading.

.4 Ambient air temperatures: Minimum minus 45°C; maximum 40°C.

.5 Elevation: 236.5 m above mean sea level.

2. PRODUCTS

2.1 LOX

.1 Provide LOX in accordance with AWWA and NSF potable water standards.

.2 Provide LOX with a guaranteed quality leaving the oxygen system as follows:

Parameter	Limits
Quality	99.5% purity minimum
Dew Point	-62°C maximum, at standard atmospheric pressure
Minimum temperature	5 °C
Maximum temperature	32 °C
Moisture	< 7.8 ppmv
Total Hydrocarbons (as CH_4)	< 20 ppm
Particle Size	≤ 1 μm

3. EXECUTION

3.1 General:

.1 The Contractor shall ensure the LOX delivery occurs according to industry standards and applicable codes and regulations.

3.2 Cleaning

.1 Piping, valving, and all other equipment in oxygen and ozone gas service supplied and installed under this Section, shall be cleaned in compliance with the CGA Pamphlet G4.1, “Cleaning Equipment for Oxygen Service,” latest edition and shall be of suitable materials for the appropriate service.

3.3 Manufacturer's Services

.1 See Section 1650 – Oxygen Equipment Installation for required Manufacturer's services.

END OF SECTION

ELECTRICAL GENERAL REQUIREMENTS

1. GENERAL

1.1 Work Included

.1 Complete and operational electrical system as required by the Drawings and as herein specified.

1.2 Drawings and Specifications

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.2 Symbols used to represent various electrical devices often occupy more space on the Drawing than the actual device does when installed. In such instances, do not scale locations of devices from electrical symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.

.3 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

1.3 Quality Assurances

.1 Codes, Rules, Permits and Fees:

.1 Comply with all rules of the Canadian Electrical Code, CSA Standard C22.1 and the applicable building codes. Do Underground Systems in accordance with CAN/CSA-C22.3 No. 7 except where specified otherwise.

.2 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

.2 Standard of Workmanship:

.1 Arrange and install products to fit properly into designated building spaces.

.2 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of Manufacturers.

1.4 Submittals

.1 See Section 11211-A – Oxygen System

1.5 Operation and Maintenance Manuals

.1 Not Applicable

1.6 Product Handling

.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.

.2 Immediately make good any damage by repair or replacement at no additional cost to the City and to the approval of the Contract Administrator.

.3 Remove advertising labels from all electrical equipment. Do not remove identification or certification labels.

.4 Remove dirt, rubbish, grease, etc. resulting from this Work from all surfaces, including the inside of all cabinets, equipment enclosures, panelboard tubs, etc.

2. PRODUCTS

2.1 Quality of Products

.1 All products provided shall be CSA Approved, ULC approved where applicable, unless otherwise specified.

.2 If products specified are not CSA approved, obtain special approval from the local regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Contract Administrator.

2.2 AREA CLASSIFICATION

.1 Unless otherwise indicated, supply equipment enclosures, boxes, electrical materials and products suitable for ambient environment of the following areas:

Area	Gen. Classification	Area Classification
Outdoor Areas	Wet	CSA 3R, 4

2.3 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture for similar products throughout the Work.

2.4 Product Finishes

.1 Finish all cabinets, panelboards, equipment cabinets, etc. in ANSI 61 grey enamel unless otherwise specified.

.2 Apply primer on all items, which are to be finished on the job.

.3 Touch up all damaged painted finishes with matching lacquer, or, if required by the Contract Administrator, completely repaint damaged surface.

3. EXECUTION

3.1 Location of Outlets and Luminaires

.1 Not Applicable

3.2 Separation of Services

.1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.

.2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.

.3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Contract Administrator and the ceiling installer, and approved clips or hangers are used.

3.3 Equipment Identification

.1 3 mm thick plastic lamicoid name plates, black face, white core, mechanically attached with self tapping screws, 6 mm high lettering, to be attached to the front face of the following equipment:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.1 Panelboard (designation, voltage, bus capacity)

.2 Terminal cabinets and pull boxes (system, voltage)

.3 Transformers (designation, capacity, primary and secondary voltage)

.2 Identify all conductors by coloured insulation and permanent markers at every terminal and accessible points throughout its entire run, as per the Canadian Electrical Code.

.3 Conductors:

.1 Equipment Grounding – Green

.2 Neutral Conductor – White

.4 Place cable metal identification markers bearing the equipment tag number on all Teck cables on both ends and all locations where the cable leaves the cable tray or penetrates a concrete wall

.5 Install red plastic warning tape, 300 mm below grade, above all underground ducts.

.6 Supply and install permanent, corrosion resistant warning markers, suitable to the local inspection authority, imbedded in the surface of concrete slabs, which are directly above high voltage cables and duct banks.

3.4 Wiring to Equipment Supplied by Others

.1 City Supplied Equipment or equipment supplied under other Divisions will be moved to the installation Site by others. However, the electrical connection to the equipment shall be done by the Contractor unless noted otherwise.

3.5 Testing

.1 Not Applicable.

3.6 Instructions to City's Personnel

.1 Not Applicable.

3.7 Access Panels

.1 Not Applicable

3.8 Sealing of Wall and Floor Openings

.1 Not Applicable

3.9 Housekeeping Pads

.1 Not Applicable

3.10 Sleeves

.1 Not Applicable

3.11 Temporary Lighting and Power

.1 Provide grounded extension cords and temporary lights required for electrical Work.

.2 Coordinate obtaining temporary power service.

.3 If City operations will be affected by any power outage required for this work, give adequate notice to the City and do not interrupt power until approval has been obtained.

.4 Give adequate notice to Contract Administrator of any power outage required for this Work. Schedule outages to provide least interference with other Work.

END OF SECTION

1. GENERAL

1.1 Requirements of Work

.1 Supply, install, Verify Performance, provide commissioning assistance, and provide warranty for a complete and fully documented I&C system as shown on the Drawings and specified herein. The I&C system will form a subsystem of the overall WTP control system and contains City Supplied Equipment and Vendor Packages as specified in this and other Sections of the Specification.

.2 Component subsystems of the I&C system will include, but are not limited to, the following:

.1 Primary elements and transmitters.

.2 Final control elements.

.3 I&C field devices.

.4 I&C junction boxes, local control panels, and marshalling panels.

.5 Instrumentation cabling.

.6 Instrumentation power supplies.

.7 Conduit and cable tray.

.8 PLC based control system.

.9 Analyzer and transmitter Manufacturer's configuration and programming software.

.3 Ensure the correct functionality of any equipment supplied under Divisions 11 and 16.

.4 Documentation provided by the Contractor shall include as a minimum:

.1 Equipment descriptive data.

.2 Equipment installation instructions, service manuals, O&M manuals, bills of materials, and recommended spare parts lists.

.3 Schematics and interconnection wiring diagrams sealed by a Professional Engineer registered in the Province of Manitoba.

.4 Records of conductor identification, field terminals, cable lists, changes, etc.

.5 I&C panel Shop Drawings, face layouts, schematics, and point-to-point wiring diagrams sealed by a Professional Engineer registered in the Province of Manitoba.

.6 Records of as-built information for the complete instrumentation system.

.7 For the PLC based control system, the Contractor shall provide detailed documentation of the system hardware.

.5 Documentation provided by the Contractor shall be formatted as follows:

.1 P&IDs – Depict the general intent of the control systems and are to be used as the governing document for the scope of Work.

.2 Instrument Index – A sorted index of the detailed information for the devices shown on the P&IDs. The index lists the appropriate support documentation for the devices' supply and installation. The instrument index is the controlling document for the supply of materials.

.3 I/O Index – A sorted index of the control system I/O points shown on the P&IDs, giving the supporting documentation as per the instrument index.

.4 Instrument Specification Sheets – Detail the relevant data for the supply of devices.

.5 Instrument Loop Diagrams – Show interconnections and hook-up of devices. The Contractor is to produce an instrument loop diagram for each device and record all relevant information on each sheet for submission at the completion of the Work. Fill in all terminal and wiring numbers etc. from the Shop Drawings as they become available. A set of 'B' size (11" x 17") AutoCAD drawings and associated files will be made available to the Contractor.

.6 Location Drawings – Indicate in plan and/or elevation views where the instrument elements are physically located. These Drawings are provided to assist the Contractor in estimating the amount of cable and ducting required.

.7 Standard Details – Provide a reference for installation, operation, and other instructions pertinent to a particular device.

.8 Detailed Specification – Lists qualifications, quality of materials and workmanship, and supplementary information.

.6 References

.1 This Specification contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section prevail.

Reference	Title
API 550	Manual on Installation of Refinery Instruments and Control Systems, Part I – Process Instrumentation and Control Section one (1) through thirteen (13)
ASME BPVC-VIII-1-2004	Rules for Construction of Pressure Vessels

ASTM B68-02	Seamless Copper Tube
ASTM D883-00	Terms Relating to Plastics
IEEE 100-00	Dictionary of Electrical and Electronic Terms
ANSI/ISA-7.0.01 1996	Quality Standard For Instrument Air
ISA 5.4-1999	Instrument Loop Diagrams
ISA S18.1-79(1992)	Annunciator Sequences and Specifications
ISA S51.1-79(1993)	Process Instrumentation Terminology
NEMA 250-2003	Enclosures for Electrical Equipment (1000 V Max)
NEMA ICS 1-00(R2005)	General Standards for Industrial Controls and Systems
NEMA ICS 2-2000	Industrial Control and Systems, Controllers, Contactors
NFPA 70-2005	National Electrical Code
SAMA PMC 17-10-63	Bushings and Wells for Temperature Sensing Elements
UBC-88	Uniform Building Code
UL 1012-89	Power Supplies
UL 94-06	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
Weik, Martin H.	Communications Standard Dictionary, Van Nostrand Reinhold Co., 1983

.7 Related Work

.1 Electrical: Division 16

.8 Codes, Rules, Permits and Fees

.1 Give all required notices, submit Drawings, obtain all permits, licenses, and certificates, and pay all fees required for this Work.

.2 Furnish a certificate of final inspection and approvals from inspection authorities to the Contract Administrator.

.9 Qualifications

.1 The instrumentation Subcontractor shall be a firm normally engaged and fully competent in the type of Work described in this Section of the Specification. The firm shall have been continuously and successfully engaged in this business for at least five (5) years.

.2 Qualified journeyman instrument mechanics that are familiar with the devices being installed shall perform all instrument hook-ups, calibrations, and checkouts.

.3 Qualified journeyman electricians shall perform all control wiring installation and connections.

.10 Standards of Workmanship

.1 Arrange and install products to fit properly into designated building spaces.

.2 Install products in accordance with the recommendations and ratings of the product Manufacturers.

.3 Supply and execute installation of all instrumentation control tubing in accordance with Section 17140 – Instrument Air Supply and Transmission.

1.2 Equipment

.1 Receiving, storing, and protection of components during construction:

.1 Examine each component upon delivery to Site. Report all damage noted to the Contract Administrator prior to accepting or rejecting delivery. All instrumentation primary elements, control components, panels, etc. shall be placed in a secure, dry, heated storage building. Maintain the space temperature above 10°C and the space relative humidity below 50%.

.2 Perform a preliminary examination upon delivery to ensure that:

.1 All I&C components supplied for this project under this Section of the Specifications comply with the requirements stated in the instrument specification sheets.

.2 All I&C components supplied under other Sections of these Specifications, to be connected to I&C components supplied under this Section of the Specifications, comply with the requirements stated in the Contract Documents.

.3 Itemize all non-conformities noted above and forward them to the Contract Administrator. Any impact on the completion of construction of this or any other work resulting from the delivery to Site of non-conforming I&C components shall be borne by the Contractor.

.4 Do not install primary elements or other sensitive equipment until construction is sufficiently completed to provide an "operating condition" environment. Notify the Contract Administrator prior to installing any equipment of this type.

.5 Ensure that covers where required are properly installed on all equipment. Provide all covers, padding, guards, etc. as required to guard any equipment against damage.

.2 Take all necessary precautions to ensure that equipment is supplied free of damage. If deemed necessary by the Contract Administrator, damaged equipment shall be replaced with new product at no additional cost to the City. The Contractor shall bear any costs due to construction delays resulting from the delay in delivery of acceptable equipment.

1.3 Documentation

.1 Submittals:

.1 Submit Shop Drawings for all products supplied by this Division. Submit Shop Drawings for review prior to purchase of any products or equipment and sufficiently in advance to allow ample time for checking.

.2 Contractor to review, modify, and approve the Shop Drawings prior to submitting Shop Drawings to the Contract Administrator for review. Contractor approval of a Drawing indicates the following:

.1 The Drawing has been checked by the person making the approval.

.2 The equipment or material complies in all respects with the requirements of the Specifications and Drawings.

.3 The quantities indicated are correct.

.4 The physical dimensions of the components are such that they can be installed without interference with the building structure or other equipment, and after installation, there are sufficient clearances on all sides for maintenance, servicing and operation of the equipment.

.5 The points of attachment are clearly indicated, i.e. TOP, BOTTOM, SIDE, etc.

.6 The arrangement and location are properly oriented.

.7 The product is suitable for its intended use.

.8 The submission consists of sufficient information to adequately convey the scope of supply and the specific product to be supplied is highlighted.

.9 The submission contains sufficient information to install the equipment or systems.

.3 Stamp and sign the Shop Drawing to show approval, indicating the above has been complied with. If Contractor revisions are too extensive, return the submission to the Manufacturer for revision, then repeat the Shop Drawing approval process before submitting to the Contract Administrator.

.4 Manufacture of products shall conform to Shop Drawings marked as reviewed by the Contract Administrator and returned to the Contractor.

.5 Keep one (1) complete, maintained set of Shop Drawings at the Job Site during the construction period. Record modifications and changes as they arise during the construction period and incorporate these changes in the Record Drawings.

.6 Refer to Division 1 for further information on Shop Drawing submittals.

2. PRODUCTS

2.1 General

.1 Refer to the requirements of Division 1**.**

.2 Selected Products:

.1 The design have been based on the use of the first named product where multiple products have been listed.

.3 Quality of Products:

.1 All products provided should be CSA approved, ULC approved where applicable, and new unless otherwise specified.

.2 If products specified are not CSA approved, obtain special approval of the relevant provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and there use subject to approval by the Contract Administrator .

.4 Uniformity of Manufacture:

.1 Unless otherwise specifically called for in the Specification, uniformity of manufacture to be maintained for similar products throughout the Work.

.5 Use of Products During Construction:

.1 Any equipment used for temporary or construction purposes is to be approved by the Contract Administrator. Clean and restore to "as new" condition all equipment prior to the time of Performance Verification.

2.2 Instrumentation

.1 General:

.1 Instruments are to be suitable for the environmental conditions in which they are to be installed.

.2 Determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation.

.3 Provide power surge protection, heating cables, and devices to protect instruments, equipment, and lines from being functionally impaired or damaged by power surges or environmental conditions such as moisture or freezing.

2.3 Identification

.1 Refer to Division 16 for general identification requirements. Provide lamacoid nameplates with 6 mm black lettering on white background. Identify the loop tag number (where applicable) and the device name, function, and instrument range or setpoint value on the nameplate.

.2 Where it is not possible to attach a lamacoid nameplate to a field instrument component, provide the component with a stainless steel metal tag firmly wired to the device and identified with the loop tag number.

.3 Identify all wires where they terminate at the marshalling panels, junction boxes, control panels, and field devices with a heat shrink sleeve with machine printed labeling.

.4 Clearly mark all panels, pull boxes, junction boxes, etc. to indicate the nature of service.

.5 Provide neatly typed circuit directories for panel power distribution systems to indicate loops or devices powered by the circuit and the fuse size.

.6 Identify all exposed control conduits at all pull box locations, where the conduits enter or leave a room, and 13 m on centre throughout the room. This shall apply to conduits above removable ceilings. Use Thomas & Betts TY-RAP 5532-M labels for conduit identification.

.7 For direct current wiring use black for positive and white for negative.

.8 For thermistor wiring to motors use red and blue coloured insulated wire.

3. EXECUTION

3.1 Product Handling

.1 Use all means necessary to protect the products included in this Division before, during and after installation, and to protect products and installed Work of all other trades.

.2 Any damage to the products and/or installed Work shall be repaired or replaced to the approval of the Contract Administrator by the Contractor.

.3 Remove advertising labels from all products installed that have such labels attached. Identification or CSA labels are not to be removed.

.4 Remove dirt, rubbish, grease, etc. resulting from Work performed under this Division of the Contract from all surfaces.

3.2 Separation of Services

.1 Maintain separation between the electrical wiring system, piping, ductwork, and the instrumentation cables so that each system is isolated (except at approved connections to such systems) to prevent galvanic corrosion. In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is unacceptable.

.2 Do not support wiring from pipes, ductwork, etc.

.3 Classifications of Circuits

.1 The circuit categorization shall of first priority follow Canadian Electrical Code with respect to separation for electrical safety and the following shall apply with respect to electro-magnetic compatibility:

Very Noisy	High voltage circuits and their associated grounding
	High current (>200 A) LV circuits.
	Harmonic-rich LV circuits.
	DC circuits: un-suppressed or above 50 V.
Noisy	Low current class two (2) circuits.
	Medium power pulsed or radio frequency circuits.
Indifferent	ELV digital status circuits.
	Intrinsically safe circuits.
	Telecommunications circuits.
	Fire alarm and emergency lighting circuits (note that some fire alarm circuits may fall into the category of signal circuits).
	Any other emergency, shutdown, or high integrity circuit (e.g. toxic gas alarm).
Sensitive	Analogue signal circuits.
	Data communication circuits.
Very Sensitive	Low level voltage and current signals (e.g. from instrument sensors).

.4 Separation of Circuits:

.1 This Section relates to the running of cables carrying differing types of circuit in close proximity to one another and to other services. Sensitive circuits shall normally be run

in overall shielded cable. Very sensitive circuits shall normally be run in individually twisted pair shielded cable.

.2 For cables sharing the same support/containment system, the following shall provide guidance to minimize extraneous interference.

Segregation between circuits	Very Noisy	Noisy	Indifferent	Sensitive	Very Sensitive
Very Noisy	Thermal grouping as per Canadian Electrical Code.	150 mm	300 mm	300 mm	300 mm
Noisy	150 mm	Thermal grouping as per Canadian Electrical Code.	150 mm	150 mm	150 mm
Indifferent	300 mm	150 mm	Separation of circuit types.	100 mm	100 mm
Sensitive	300 mm	150 mm	100 mm	Touching	50 mm
Very Sensitive	300 mm	150 mm	100 mm	50 mm	Touching

3.3 Wire and Cable

.1 Refer to Section 17124 – Instrumentation Cable.

3.4 Equipment Connections

.1 Prior to the connection of signal wiring to process control and instrumentation devices, check the device voltage rating and polarity for compatibility with the corresponding loop and/or schematic diagram. Where device and circuit characteristics are found to be incompatible, the connections are not to be made. Report the condition immediately to the Contract Administrator.

.2 All control wiring diagrams illustrate typical control circuits applicable to the type of equipment specified. Control circuits may vary with different manufacturer's equipment. Verify all control circuits with the Manufacturers of the equipment and make any corrections to the control wiring diagrams that may be required.

.3 Provide power disconnect terminals in marshalling panels for all devices and PLC I/O sourced from the panel. Provide local power disconnect switches for all 120 VAC power instruments. Mount adjacent the instrument.

.4 Provide a disconnecting means in the cable connecting each ultrasonic transponder to the transmitter. This disconnect shall consist of a terminal strip in a local water proof junction box.

3.5 Access Panels

.1 Provide access panels where I&C system junction boxes are concealed. Panels to be of adequate size for servicing of the concealed junction box and complete with necessary frames and hinged doors held closed with captive fasteners.

.2 In removable ceiling areas provide markers on ceiling tile to locate equipment requiring access. Use a 25 mm diameter blue circle painted on the access panel to indicate that it is for instrumentation and control system access.

3.6 Instrument Mounting Stands

.1 Supply and install instrumentation mounting stands as required. Stands are to be either floor or wall mounted. The mounting stands are to be fabricated from aluminum or galvanized steel.

.2 Supply and install protective drip shields for any exterior stand-mounted instrumentation equipment. The drip shield is to extend 50 mm at the top and sides from the front face of the equipment. The drip shield is to be fabricated from aluminum.

3.7 Tagging Standards for Devices and Wiring

.1 Tag all devices, wires, and I/O using the assigned loop, equipment, or device tag name. Where tag naming and numbering is not specified, the Contract Administrator will provide naming and numbering that is consistent with the WTP naming conventions.

3.8 Testing of Instrumentation Loops

.1 After all devices within a loop have been connected, check the loop for correct functioning and interaction with other loops, where applicable. Provide written notice to the Contract Administrator when the loops are going to be tested so that the tests may be witnessed at the Contract Administrator's discretion.

.2 Check the operation of final control elements such as solenoid valves, actuators, etc. by manual control before checking with automatic control.

.3 Check and simulate all alarms and shutdown functions.

.4 Verify the status of all points connected or accessible to the WTP control and monitoring system.

.5 Where applicable, test all tubing for leaks in compliance with the ISA RP7.1. Isolate all instruments when tubing is being tested to protect against over pressure.

.6 Perform tests and record results on the test data forms that are included in this Section. Develop additional and/or more detailed test forms as necessary to suit more complex instrumentation.

.7 Sign and date all test reports. Submit the test reports to the Contract Administrator within five (5) Business Days of testing.

3.9 Calibration

.1 Instruments are to be factory pre-calibrated. Verify calibration after installation for all instruments installed under these Specifications. Provide a printed record of the factory calibration parameters for "smart" devices.

.2 Prior to calibration, completely program all "smart" transmitters including entries of the appropriate range and tag number. Provide a printed record of smart device serial numbers against their assigned tag number.

.3 Instruments are to be set up and calibrated by an accredited instrument technician working under the approval of the instrument Manufacturer.

.4 Calibrate all instruments to an accuracy of 0.5% of full range, or to the manufacturer's stated accuracy of the instrument whenever an accuracy of 0.5% is not achievable.

.5 Perform the following applicable calibration verification for each instrument and its associated signal conditioning equipment:

.1 Calibrate all inline flow meters by a draw-down test.

.2 Calibrate all density meters by lab samples.

.3 Calibrate all vacuum and pressure instruments by manometer or accurate test instrument and hand test pump.

.4 Calibrate gas detectors using standard gas samples.

.5 Calibrate temperature instruments against a standard lab thermometer.

.6 Online analyzers with known samples.

3.10 Test Forms

Form No.	Title
.1 ITR	Instrument Test Report.
.2 LCR	Loop Check Report.

INSTRUMENT TEST REPORT FORM NO. ITR

SYSTEM: _____ _____

SERVICE: _____ TAG NO.: _____

LOCATION: _____ _____

MAKE: _____ MODEL: _____

SERIAL NO.: _____ CSA: _____

ELEMENT: _____ RANGE: _____

DESIGN SETTING/RANGE: _____ CONTACT TO: _____ ON: _____

SIGNAL IN: _____ OUT: _____ ASSOCIATED INSTRUMENT:_____

INSTRUMENT CONDITION: _____ CONFORM TO SPEC: _____

PROJECT NO: _____ DATA SHEET: _____

	TEST 1				TEST 2			
TEST METHOD								
	INPUT		**OUTPUT**		**INPUT**		**OUTPUT**	
PROCESS	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**
TEST POINT 1								
TEST POINT 2								
TEST POINT 3								
TEST POINT 4								
TEST POINT 5								
COMMENTS								
GRAPHS								

TESTED BY: _____ CHECKED BY: _____

DATE: _____ DATE: _____

LOOP CHECK REPORT FORM NO. LCR

☐ CHECKED OUT OK

☐ NOT APPLICABLE

☐ FURTHER ACTION REQUIRED

	INSTRUMENT TAG NO.								
LOOP NO. _____ SHEET NO. _____ P & I DWG. NO. _____									
INSTALLATION COMPLETE									
Primary Element.									
Impulse Lines.									
Block and Drain Valves.									
Air Supply/Filter/Reg.									
Wiring.									
Tracing/Insulation/Housing.									
Mounting and Location.									
PLC/SCADA I/O & Status.									
CALIBRATED									
Impulse Lines Press. Tested.									
LOOP CHECKED									
Element to Receiver.									
X Mtr. To Receiver.									
X Mtr./Trans. to Receiver.									
X Mtr./Trans. to Switches.									
Switches to Annunciator.									
Interlocking Circuit.									
Controller to Valve.									
Controller Action D or R.									

REMARKS:

READY FOR START-UP

Date: _____

Installed by: _____

Checked by: _____

3.11 Installation and Performance Testing

.1 Refer to the requirements of Division 1 for additional requirements.

.2 Inspections:

.1 Provide two (2) weeks' written notice to the Contract Administrator prior to energizing any system to allow for inspection by the Contract Administrator of the following:

.1 Proper mounting.

.2 Proper connections.

.3 During Performance Verification, demonstrate to the Contract Administrator proper calibration and correct operation of instruments and gauges.

.4 Performance Verification of the I&C system is to include but not be limited to the following:

.1 Verify installation of components, wiring connections, and piping connections.

.2 Supervise wiring continuity and pipe leak tests.

.3 Verify instrument calibration and provide written reports.

.4 Function check and adjust the I&C equipment under operational conditions.

.5 Coordinate manufacturer’s service personnel as required for complete system testing.

.6 Instruct WTP personnel in correct method of I&C equipment operation.

.7 Direct WTP personnel at hand-over as to final adjustment of the system for correct operation of WTP.

.8 Ensure that the Manufacturer’s representatives cooperate to complete the Work of this Section.

.9 Verify signal levels and wiring connections to all I&C equipment.

.10 Coordinate and cooperate with City staff and the Contract Administrator during the Commissioning Period to commission the interface between the Plant SCADA and the PLC based control system.

3.12 Training

.1 Provide training, in the proper operation and maintenance of all control devices, control valves, and ancillary instrumentation described under this Division of the Specifications.

END OF SECTION

SCOPE OF INSTRUMENTATION AND CONTROL WORK

1. GENERAL

.1 Supply and installation all material, equipment, wiring and labour necessary for the installation of the systems detailed on the Drawings in accordance with the Specifications and the latest edition of the Canadian Electrical Code.

2. WORK INCLUDED

2.1 Related Work

.1 Supply and installation of I&C equipment required to operate the WTP including the plant control system PLC equipment and all vendor packages and City Supplied Equipment as indicated on the P&ID's and in these specifications.

2.2 General Requirements

.1 Shop Drawings

.2 Record Drawings

.3 O&M Data

2.3 Specific Requirements

.1 Supply, install, test, and verify the performance of all instrumentation, components, materials and ancillary equipment covered under Division 17 of this Contract.

.2 Provide a weatherproof, insulated and heated enclosure suitable for the local conditions to contain all the control and communications equipment described in these Specifications and Drawings.

.3 Provide local control panels to act as a marshalling panel for signals from instrumentation and equipment covered under Division 17.

.4 Provide a 4 to 20mA LOX level signal from each storage tank for connection to the plant control system. The connecting cables will be by others.

.5 Supply redundant 24 VDC Power supplies installed within the local control panels whenever 24 VDC power is required.

.6 Provide power-conditioning equipment within each local control panel.

.7 Connect the healthy/fault status dry relay contacts from all power conditioning and UPS equipment to local PLC inputs.

.8 All WTP control system PLC programming and WTP monitoring system HMI software development shall be performed by others.

.9 Coordinate with the Supply Contractors of City Supplied Equipment under other contracts but installed under this Contract to install, test and verify performance of the systems shown on the P&IDs.

2.4 Additional Requirements

.1 Provide all necessary testing, detailed wiring continuity checks, installation integrity checks, equipment functional operation checks, and written system verification reports to provide a complete system that is ready for commissioning.

.2 Provide Performance Verification and Commissioning of all systems included in the Scope of Work.

2.5 Materials

.1 Cables and bus support systems, which are intended to enclose or support all forms of electrical conductors used for any purpose covered by this scope. This includes cable trays, raceways and all forms of rigid, flexible, metallic and non-metallic conduit, and including conduit for communication systems.

.2 Control panels associated with any electrical equipment covered under this Section of Work.

.3 Circuit breakers of all types and for all applications associated with electrical equipment, which receives its power supply from the main, auxiliary or emergency (including UPS) system.

.4 Grounding systems, as required by the Canadian Electrical Code, or as otherwise specified.

.5 Electronic data processing and transmission systems, including auxiliary equipment, interfaces and components.

END OF SECTION

ENCLOSURES

1. GENERAL

1.1 References - General

.1 Equipment, products, and execution must meet all requirements detailed in Section 17010 – Instrumentation and Control General Requirements.

2. PRODUCTS

2.1 General

.1 Unless otherwise specified, provide outside finishes on all enclosures in ANSI 61 Grey.

.2 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

2.2 Enclosures

.1 All enclosures for mounting outside of MCC rooms and control rooms to be EEMAC Type 4, watertight except where otherwise specified.

.2 Enclosures for mounting field control indicator lamps and switches in unclassified areas to be Allen Bradley model 800T-xTZ die cast enclosures.

.3 Enclosures for mounting field control indicator lamps and switches in Class 1 areas to be Allen Bradley model 800H-xHHX7 cast aluminum enclosures.

2.3 Panel Enclosures

.1 Fabricate panel enclosures from 11-gauge steel panels complete with necessary stiffening to form a rigid free-standing lineup. The structures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors. Provide removable top and bottom cable entry plates.

.2 Provide panels with front access only. Doors shall be key lockable and fitted with 3-point heavy duty latching assemblies. Provide a continuous piano hinge and a pneumatic hold open device on each door.

.3 Finish the interior of the enclosure with white paint. Provide a switched fluorescent light fixture and a 120 VAC duplex convenience receptacle inside the enclosure.

2.4 Marshaling and Control Panels

.1 Supply, fabricate, checkout, layout, document and deliver to Site fully equipped and functional panels.

.2 Supply all components contained on or within the panels fully wired under this Section of the Specification.

.3 The selection of all accessories, materials, and methods for fabrication not covered by this Specification, but which are necessary to complete the fabrication of the control panels, is the responsibility of the Contractor.

.4 Fans and filters shall be installed to pressurize all control panels thus discouraging dust accumulation and providing air purging for temperature and corrosion control.

.5 Control panel layouts and wiring diagrams are to be provided by the Contractor as Shop Drawings.

2.5 Wiring and Accessories

.1 Provide wiring inside the panels according to the following Specifications:

.1 Control wiring to be a minimum of #16 AWG tinned stranded copper; insulation rated at 600 V.

.2 Wiring for power distribution shall be a minimum of #14 AWG tinned stranded copper; insulation rated at 600 V.

.3 Install cables in accordance with the requirements of Division 16.

.2 Tag each wire at both ends with a heat shrink sleeve that is machine printed. Allow approximately 20 mm of wire insulation between the tag and the bare wire.

.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.4 Run all wiring in enclosed plastic wire ways such as Panduit. Size all wire ways so that the total cross sectional area of the insulated wire and cable does not exceed 40% of the cross sectional area of the wire way.

.5 Provide a minimum clearance of 50 mm between wire ways and any point of wire termination.

.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the panels. Identify each terminal strip with a terminal strip number, defined as follows:

.1 Wire identification to use the connected field device tag name with the wire's corresponding end device terminal number appended to it.

.2 Identify every joint and/or terminal of the above wire run with the same identifier.

.3 For example, pressure transmitter PT-O100A located in the field has a 1 PR-TPSH cable connected to it. The cable runs through a junction box to a marshalling panel.

The wire identifiers for the pair of wires would be PT-O100A all the way to the marshalling panel.

.4 Identify spare wires by using the cable tag, terminal number and an "-SP" suffix.

.5 Arrange wiring on terminal blocks such that all internal panel wiring terminates on the inboard side of the terminal blocks and all external wiring terminates on the outboard side.

.7 Provide two (2) sources of 120 VAC power to each control panel: UPS power for critical loads and non-UPS power for non-critical loads. Provide separate critical and non-critical 120 VAC power distribution systems and a 24 VDC power distribution system in each panel. Provide a thermal magnetic circuit breaker on each main power circuit and a fused terminal block for each branched circuit off the main.

.8 Provide disconnect type terminal blocks Weidmuller WTR 4 series to isolate field wiring that is powered sourced from the panel. Provide a dedicated fused disconnect type terminal block to isolate each individual PLC input and output.

.9 Provide sufficient terminals so that not more than two (2) wires are connected under the same terminal. Provide 20% spare terminal capacity at each terminal block assembly.

.10 Terminals shall be Weidmuller W Series color coded as follows:

.1	Red	=	positive 24 VDC
.2	Black	=	analog signal plus
.3	White	=	analog signal common and VAC neutral
.4	Grey	=	120 VAC
.5	Green	=	ground
.6	Yellow	=	shield

.11 Provide nameplates for each device on or within the panels and enclosures. Nameplates shall be white lamacoid with black lettering, a minimum of 25 x 75 mm in size with up to three lines of 5 mm lettering. Securely fasten nameplates in and situate them in a visible location.

2.6 Panel Grounding

.1 Provide a ground system for the instrumentation circuits, isolated from the main power system ground to each marshalling panel.

.2 Provide grounding lugs for each panel, suitable for termination of up to #2 AWG copper grounding conductor.

.3 Provide in each marshalling panel an isolated grounding bus bar 6 x 25 x 600 mm, equipped with necessary lugs for accepting two #2 AWG grounding conductors.

.4 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

3. EXECUTION

3.1 References - General

.1 Refer To Section 17010 – Instrumentation and Control General Requirements, Part 3.

END OF SECTION

INSTRUMENTATION CABLE

1. GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 01300 - Submittals.

1.2 Related Work

.1 Refer to Division 16 – Electrical.

1.3 Inspection

.1 Provide adequate notice to the Contract Administrator so that all cable installations can be inspected prior to energizing equipment.

1.4 Standards

.1 All wire and cable shall be CSA approved.

2. PRODUCTS

2.1 Twisted Pair Shielded (TPSH)

.1 TPSH shall be constructed as follows:

.1 Two (2) copper conductors, stranded, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm.

.2 Insulated for 600 V, 90°C.

.3 100% coverage aluminum foil or tape shield.

.4 Separate bare stranded copper drain wire, minimum #18 AWG.

.5 Overall flame retardant PVC jacket to CSA-C22.2.

.6 The entire cable assembly to be suitable for pulling in conduit or laying in cable tray.

.7 Shawflex Type 1751-CSA or Belden equivalent.

.2 Where multi-conductor TPSH cables are called for, each pair shall be individually shielded, continuous number coded, and the cable assembly shall have an overall shield and overall flame retardant PVC jacket.

2.2 RTDs and Multi Conductor Shielded Cable

.1 RTD cables shall be CSA approved and shall be constructed as follows:

.1 Three (3) or more copper conductors, stranded, minimum #18 AWG

.2 PVC insulated for 600 V

.3 100% coverage aluminum foil or tape shield

.4 Separate bare stranded copper drain wire

.5 Overall flame retardant PVC jacket to CAS-C22.2

2.3 Teck Cables

.1 As per Division 16 – Electrical.

2.4 Wire

.1 As per Division 16 – Electrical.

3. EXECUTION

3.1 Analog Signals

.1 Use TPSH cable for all low level analog signals such as 4 to 20 mA, pulse type circuits 24 VDC and under, and other signals of a similar nature.

.2 Use RTD cable for connections between RTDs and transmitters or PLC RTD inputs.

3.2 Digital Signals

.1 Use TPSH cable for all low level (24 V and below) input and output signals.

3.3 Instrument Power

.1 Use Teck cable or wire and conduit for power to instruments, for 120 V signals other than those mentioned above and as otherwise indicated on the Drawings. Use stranded wire and cable to supply power to instruments.

3.4 Installation

.1 Install instrumentation cables in conduit systems or in cable trays. Use a minimum of 300 mm and a maximum of 1000 mm length of liquid tight flexible conduit to connect the field sensors to the conduit.

.2 Where non-armoured instrumentation cables are installed in cable trays, provide barriers in the tray to separate instrumentation cables from power cables.

.3 At each end of the run leave sufficient cable length for termination.

.4 Do not make splices in any of the instrumentation cable runs.

.5 Cable shields shall be terminated on insulated terminals and carried through to the extent of the cable.

.6 Ground cable shields at one end only. Unless otherwise specified, ground the shields at the marshalling panel.

.7 Protect all conductors against moisture during and after installation.

3.5 Cat 5E Installation

.1 Always follow the Manufacturer's guidelines for minimum bend radius and tension.

.2 All installations and terminations shall be performed by personnel experienced in Cat 5E cable installation.

.3 Perform cable testing with time domain reflectometer instrument and provide complete detailed test report. Test all runs upon completion of permanent terminations, using instrumentation acceptable to Contract Administrator. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.

.1 Test for the following:

.1 Continuity.

.2 Pair placement and polarity.

.3 DC resistance.

.4 Characteristics at highest contemplated frequency:

.1 Attenuation - data cable.

.2 Mutual Capacitance - data cable.

.3 Near-end crosstalk (NEXT) - data cable.

.5 Run length.

.2 Tests to be conducted to Cat 5E standards

.3 Reconnect or re-install and retest as necessary to correct excessive variations.

3.6 Conductor Terminations

.1 All equipment supplied shall be equipped with terminal blocks to accept conductor connections.

.2 Instrumentation conductors, where terminated at equipment terminals other than clamping type terminal blocks, shall be equipped with Burndy-YAE-2 or STA-KON, self-insulated, locking type terminators, sized as required to fit conductors and screw terminals.

3.7 Testing

.1 Test all conductors for opens, shorts, or grounds. Resistance values shall not be less than those recommended by the cable Manufacturer.

3.8 Identification

.1 Identify all instrumentation cables.

.2 Identify each conductor with wire numbers using a machine printed Raychem TMS heat shrink wire marker or approved equal.

END OF SECTION

TRANSMITTERS AND INDICATORS

1. GENERAL

1.1 References - General

.1 Equipment, products and execution must meet all requirements detailed in Section 17010 – Instrumentation and Control General Requirements.

2. PRODUCTS

2.1 Transmitters and Indicators

.1 Supply and install transmitters and indicators as specified on the Instrument Specification Sheets of Section 17701 – Instrument Specification Sheets.

.2 Transmitters shall have adequate power output to drive all devices associated with the signal loop. Provide signal boosters as required to achieve adequate signal strength or to isolate the signal. Provide current-to-current signal isolators for all secondary devices in the control loop.

.3 All transmitters to have local indication scaled in engineering units as specified in the Specifications. Provide a lamicoid label indicating the calibrated range and engineering units and mount adjacent to the transmitter. Mount the transmitter so the indicator is visible by operations personnel.

.4 Remote indicators provided by Crompton Instruments, Simpson, or Newport are acceptable for use.

.5 Where the loop specification calls for a transmitter and an indicator to be mounted in the same panel, an indicating transmitter may be considered acceptable, provided the indicator is normally visible from outside the enclosure.

.6 Where available as an option, the transmitter shall be supplied with an isolated fault contact.

.7 Standard of acceptance for instrumentation shall be as follows:

.1 Pressure Transmitters: Rosemount Model 3051, ABB or Foxboro complete with stainless steel two (2) and three (3) valve manifolds as manufactured by Anderson Greenwood.

.2 Pressure Gauges: Ashcroft, H.O. Trerice, Budenberg.

.3 Temperature Transmitters (RTD): Rosemount, ABB, Foxboro.

3. EXECUTION

3.1 References - General

.1 Refer to Section 17010 – Instrumentation and Control General Requirements.

END OF SECTION