THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY 238-2007

KILDARE LAND DRAINAGE FLOOD PUMPING STATION
MECHANICAL AND ELECTRICAL WORKS

TABLE OF CONTENTS

PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

KILDARE LAND DRAINAGE FLOOD PUMPING STATION
MECHANICAL AND ELECTRICAL WORKS

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, June 29, 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 C3.1, the Bidder may view the Site without making an appointment.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.

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 notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

B4.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B4.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B4.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B4 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 Plant, Materials and methods 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 five (5) 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 Plant, Material or method 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 proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;

(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 proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

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 may 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 B15.

B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B7. BID COMPONENTS

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

(a) Form A: Bid;

(b) Form B: Prices;

(c) 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 Further to B7.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B6.

B7.3 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.

B7.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.4.1 Samples or other components of the Bid 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.

B7.5 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.

B7.6 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.

B7.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.8 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 the lump sum price in Canadian funds for the Work on Form B: Prices.

B9.1.1 Notwithstanding C12.2.3(c), the price on Form B: Prices shall not include the Manitoba Retail Sales Tax (MRST, also known as PST), which shall be extra where applicable.

B10. QUALIFICATION

B10.1 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; 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.

B10.2 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).

B10.3 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);

B10.4 Further to B10.3(c), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, provide 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.)

B10.5 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.

B10.6 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.

B11. BID SECURITY

B11.1 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.

B11.1.1 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.

B11.1.2 All signatures on bid securities shall be original, and shall be witnessed or sealed as required.

B11.2 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.

B11.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B11.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B11.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B11.3 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.

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

B12.1 Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Branch, or in such other office as may be designated by the Manager of Materials.

B12.1.1 Bidders or their representatives may attend.

B12.1.2 Bids determined by the Manager of Materials, or his designate, to not include the bid security specified in B11 will not be read out.

B12.2 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.

B12.3 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.

B12.4 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.

B13. IRREVOCABLE BID

B13.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B13.2 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 until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

B14. WITHDRAWAL OF BIDS

B14.1 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.

B14.1.1 Notwithstanding C23.3, 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.

B14.1.2 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.

B14.1.3 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 B14.1.3(b), declare the Bid withdrawn.

B14.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B13.2 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.

B15. EVALUATION OF BIDS

B15.1 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 B10 (pass/fail);

(c) Total Bid Price;

B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid 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.

B15.3 Further to B15.1(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.

B15.4 Further to B15.1(c), the Total Bid Price shall be the lump sum price shown on Form B: Prices.

B15.4.1 If there is any discrepancy between the lump sum price written in figures and the lump sum price written in words, the price written in words shall take precedence.

B16. AWARD OF CONTRACT

B16.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B16.2 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.

B16.2.1 Without limiting the generality of B16.2, 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.

B16.3 Subject to B16.2, 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.

B16.3.1 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.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

C0.1 The *General Conditions for Construction* (Revision 2006 12 15) are applicable to the Work of the Contract.

C0.1.1 The *General Conditions for Construction* 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.

C0.2 A reference in the Bid Opportunity to a section, clause or subclause with the prefix "**C**" designates a section, clause or subclause in the *General Conditions for Construction*.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

D1.1 In addition to the *General Conditions for Construction*, these Supplemental Conditions are applicable to the Work of the Contract.

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of providing submersible pumps and electrical services to the new Kildare Flood Pumping Station. The Station civil works are nearing completion under another contract with the electrical room scheduled for construction in summer 2007.

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

(a) Provide two submersible pumps and related pump discharge pipes.

(b) Provide electrical service to the new Flood Pump Station building and the submersible pumps.

(c) Supply, install, test and commission mechanical and electrical systems as specified.

D3. CONTRACT ADMINISTRATOR

D3.1 The Contract Administrator is KGS Group, represented by:

Rudy Derksen, P. Eng.
Senior Mechanical Engineer
3rd Floor – 865 Waverley Street, Winnipeg, Manitoba, R3T 5P4
Telephone No. (204) 896-1209
Direct No. (204) 478-3246
Facsimile No. (204) 896-0754
Email rderksen@kgsgroup.com

D3.2 At the pre-construction meeting, Rudy Derksen will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D4. CONTRACTOR'S SUPERVISOR

D4.1 At the pre-construction meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D5. NOTICES

D5.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D5.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D5.3, D5.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D3.1.

D5.3 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

D5.4 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. FURNISHING OF DOCUMENTS

D6.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

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. SAFE WORK PLAN

D8.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D8.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which 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.

D9. INSURANCE

D9.1 The Contractor shall provide and maintain the following insurance coverage:

(a) commercial general liability insurance, in the amount of at least two million dollars ($2,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain a contractual liability, unlicensed motor vehicle liability, non-owned automobile liability and products and completed

operations, to remain in place at all times during the performance of the Work and throughout the warranty period;

(b) automobile liability insurance for owned automobiles used for or in connection with the Work in the amount of at least two million dollars ($2,000,000.00) at all times during the performance of the Work and until the date of Total Performance;

D9.2 Deductibles shall be borne by the Contractor.

D9.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract.

D9.4 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. PERFORMANCE SECURITY

D10.1 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 Contract 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 Contract 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 Contract Price.

D10.1.1 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.

D10.2 If the bid security provided in his Bid was not a certified cheque or draft pursuant to B11.1(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 letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D11. DETAILED PRICES

D11.1 The Contractor shall provide the Contract Administrator with a detailed price breakdown (Form I: Detailed Prices) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D11.2 The Contractor shall state a price for each item or sub-item of the Work identified on Form I: Detailed Prices. The detailed prices must be consistent with the price(s) provided in the Contractor’s Bid.

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 but in no event later than the date specified in C4.1 for the return of the executed Contract.

D13. DETAILED WORK SCHEDULE

D13.1 The Contractor shall provide the Contract Administrator with a detailed work schedule (Form L: Detailed Work Schedule) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D13.2 The schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

(a) Pump Discharge Pipe Delivery

(b) Delivery of Pumps

(c) Installation of Electrical Systems

(d) Electrical System Commissioning

(e) Training of City Personnel

(f) Pump Testing under Flow Conditions

SCHEDULE OF WORK

D14. COMMENCEMENT

D14.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D14.2 The Contractor shall not commence any Work on the Site prior to March 1, 2008 and 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 C6.15;

(iii) the Safe Work Plan specified in D8;

(iv) evidence of the insurance specified in D9;

(v) the performance security specified in D10;

(vi) Detailed Prices specified in D11

(vii) the Subcontractor list specified in D12; and

(viii) the detailed work schedule specified in D13.

D14.3 The City intends to award this Contract by August 29, 2007.

D14.3.1 If the actual date of award is later than the intended date, the dates specified for Critical Stages, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

D15. CRITICAL STAGES

D15.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

(a) Deliver pump discharge pipes to the site by November 1, 2007

(b) Finish system commissioning including pump testing with water by March 15, 2009.

D16. SUBSTANTIAL PERFORMANCE

D16.1 The Contractor shall achieve Substantial Performance by March 31, 2009.

D16.2 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.

D16.3 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. Substantial Performance will not be achieved until pump testing has been satisfactorily completed.

D17. TOTAL PERFORMANCE

D17.1 The Contractor shall achieve Total Performance by June 30, 2009.

D17.2 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.

D17.3 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.

D18. LIQUIDATED DAMAGES

D18.1 If the Contractor fails to achieve critical stages, Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per Working Day for each and every Working Day following the days fixed herein for same during which such failure continues:

(a) Deliver pump discharge pipes; One thousand dollars ($1,000.00);

(b) Substantial Performance – one thousand dollars ($1,000.00);

(c) Total Performance – five hundred dollars ($500.00).

D18.2 The amounts specified for liquidated damages in D18.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve critical stages, Substantial Performance or Total Performance by the days fixed herein for same.

D18.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D19. SCHEDULED MAINTENANCE

D19.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) Pump maintenance as required by the pump manufacturer;

D19.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

CONTROL OF WORK

D20. JOB MEETINGS

D20.1 Job meetings will be held as required. 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 C6.24, 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).

MEASUREMENT AND PAYMENT

D22. PAYMENT

D22.1 Further to C12, effective January 1, 2007 the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

D23. PAYMENT SCHEDULE

D23.1 Further to C12, payment shall be in accordance with the Form I Detailed Prices breakdown, as agreed to with the City.

WARRANTY

D24. WARRANTY

D24.1 Notwithstanding C13.2, the warranty period shall begin on the date of Substantial Performance and shall expire one (1) year thereafter unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.

FORM H1: PERFORMANCE BOND
(See D10)

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. 238-2007

KILDARE LAND DRAINAGE FLOOD PUMPING STATION
MECHANICAL AND ELECTRICAL WORKS

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 D10)

_____
(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. 238-2007

KILDARE LAND DRAINAGE FLOOD PUMPING STATION
MECHANICAL AND ELECTRICAL WORKS

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 I: DETAILED PRICES
(See D11)

KILDARE LAND DRAINAGE FLOOD PUMPING STATION

MECHANICAL AND ELECTRICAL WORKS

ITEM NO.	DESCRIPTION	SPEC. REF.	UNIT	APPROX. QUANTITY	UNIT PRICE	AMOUNT
1.	Supply of pumps	11000	-	-	-	
2.	Supply of pipes	11000	-	-	-	
3.	a) Installation of pumps	15100	-	-	-	
	b) Testing & Commissioning	15100	-	-	-	$20,000
	c) As-built and O&M Manuals	15100	-	-	-	$10,000
4.	Ventilation	15800	-	-	-	
5.	Electrical	16000	-	-	-	

FORM J: SUBCONTRACTOR LIST
(See D12)

Name	Address

FORM L: DETAILED WORK SCHEDULE

(See D13)
KILDARE LAND DRAINAGE FLOOD PUMPING STATION
MECHANICAL AND ELECTRICAL WORKS

For each item of Work, indicate the proposed date that each cumulative percentage to be completed will be achieved.					
Items of Work	Percentage of Work Completed				
	Start	25%	50%	75%	100%
Pump Discharge Pipe Delivery - Must be on-site by November 1, 2007					
Delivery of Pumps					
Installation of Electrical Systems					
Electrical System Commissioning					
Training of City Personnel					
Pump Testing under Flow Conditions - Must be completed by March 15 2009					

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS

E1.1 These Specifications shall apply to the Work.

E1.2 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.2.1 *The City of Winnipeg Standard Construction Specifications* 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.

E1.2.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.2.3 Further to C2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.3 The following technical specifications are applicable to the Work:

Specification No.	Specification Title
	Mechanical
11000	Supply of Submersible Pumps and Discharge Pipes
15010	Mechanical General Provisions
15100	Install Pumps
15800	Ventilation System
	Electrical
16010	Electrical General Requirements
16051	Installation Of Cables In Trenches And In Ducts
16062	Grounding Secondary
16071	Fastening And Supports
16122	Wires And Cables (0-1000 V)
16131	Splitters, Junctions, Pull Boxes And Cabinets
16132	Outlet Boxes, Conduit Boxes And Fittings
16133	Conduit, Conduit Fastenings And Conduit Fittings
16141	Wiring Devices
16151	Wiring And Box Connectors (0-1000 V)
16223	Motor Starters To 600 V
16275	Dry Type Transformers
16412	Moulded Case Circuit Breakers
16414	Disconnected Switches - Fused And Non-Fused
16441	Panelboards Breaker Type
16481	Reduced Voltage Starter (Solid-State)
16505	Lighting Equipment
16701	Instrument Specifications

E2. CONSTRUCTION DRAWINGS

E2.1 The following drawings apply to this Work.

DWG. No.	Sheet No.	Description	REV.
05-107-17-00		TITLE SHEET & DRAWING INDEX	00
CC5-48aM-001c	01	PUMPS AND VENTILATION PLAN AND SECTION	00

DWG. No.	Sheet No.	Description	REV.
CC5-48aE-001c	01	FLOOD PUMPING STATION PLAN AND DETAILS	00
CC5-48aE-002c	01	SINGLE LINE DIAGRAM	00
CC5-48aE-003c	01	FLOOD PUMP - FP-1 SCHEMATIC/WIRING DIAGRAM	00
CC5-48aE-004c	01	FLOOD PUMP - FP-2 SCHEMATIC/WIRING DIAGRAM	00
CC5-48aE-005c	01	CONTROL INDICATION AND ALARM SCHEMATICS AND WIRING DIAGRAM	00
CC5-48aE-006c	01	FLOOD PUMPING STATION MISCELLANEOUS DETAILS	00
CC5-48aE-007c	01	FLOOD PUMPING STATION PLANS. SECTION AND SCHEDULES	00

E3. REFERENCE DRAWINGS

E3.1 The following drawings are provided with the permission of the Manitoba Floodway Authority for information purposes only for the project.

DWG. No.	Sheet No.	Description	REV.
CC5-48aS-001c	01	CONCRETE - SECTIONAL PLANS AT EL 237.65 AND 232.15	01
CC5-48aS-002c	01	CONCRETE - SECTIONAL PLANS AT EL 228.00. 224.25 AND 222.65	01
CC5-48aS-003c	01	CONCRETE SECTIONS A AND B	01
CC5-48aS-004c	01	CONCRETE SECTIONS C AND D	02
CC5-48aS-005c	01	CONCRETE SECTIONS E AND F	01
CC5-48aS-006c	01	CONCRETE AND REINFORCING OUTLET STRUCTURE AND SLAB PLUG	00
CC5-48aS-007c	01	REINFORCING - SECTIONAL PLANS AT EL 237.65 AND 232.15	00
CC5-48aS-008c	01	REINFORCING - SECTIONAL PLANS AT EL 228.00, 224.25 AND 222.65	01
CC5-48aS-009c	01	REINFORCING SECTIONS A, B & C	01
CC5-48aS-010c	01	REINFORCING SECTIONS C AND D	01

DWG. No.	Sheet No.	Description	REV.
CC5 –48aS-011c	01	REINFORCING SECTIONS E AND F	00
CC5-48aS-012c	01	HATCH COVERS SECTIONS AND DETAILS	00
CC5-48aS-013c	01	TRASH RACKS & FLOW STRENGTHERS SECTION AND DETAILS	00
CC5-48aS-014c	01	MISCELLANEOUS METAL SECTIONS AND DETAILS	00
CC5-48aS-015	01	ELECTRICAL ROOM PLAN, SECTION, ELEVATIONS & DETAILS	00
CC5 – 48aC-001c	01	ROAD ACCESS PLAN. PROFILE AND SECTIONS	00

1. GENERAL

1.1 Scope

.1 The scope of this section includes the design, supply, delivery, installation assistance and commissioning of all equipment and appurtenances required for the Pumps, Monitoring modules, and associated Pump Discharge Pipes.

.2 Scope of Supply consists of the following major items:

- .1 Two (2) pumps, complete with lifting system, power and control cables.
- .2 Pump Monitoring equipment.
- .3 Two (2) fabricated, pump discharge pipes. This pipe will be installed under another contract.
- .4 Deliver the equipment specified to the project site. Pump discharge pipes must be delivered prior to the date listed in D15 Critical Stages.
- .5 Provide installation training;
- .6 Supervise installation of the pumps.
- .7 Supervise equipment performance testing and commissioning.
- .8 Provide As-Built mark-up drawings documenting all changes made.
- .9 Provide technical support and remedy defects during the Warranty Period.

.3 The supplied equipment shall include all accessories required to ensure the supplied equipment safely and satisfactorily operates as an integral system as required by the Bid Opportunity.

.4 Provide any appurtenances or services not specifically mentioned or included in the Contract Documents but which are necessary as part of the Work to ensure that the equipment is fully operational when installed.

1.2 Shop Drawings

.1 Show pump electrical cable & pump lifting system details

.2 Provide discharge pipe shop drawings.

1.3 Operating and Maintenance Manuals

.1 Prior to the time of Equipment Performance Testing, submit to the Contract Administrator for review two (2) draft copies of Operating and Maintenance (O&M) manuals containing information required by the Specifications. All instructions in these manuals shall be in simple language to guide the City in the proper operation and maintenance of the installation.

.2 Submit O & M manuals in paper format.

.3 Furnish four (4) complete O & M. Provide information as specified in this Section for installation check-out, operation, maintenance, and lubrication requirements for each unit of mechanical, electrical, and instrumentation equipment or system and each instrument.

.4 Customize the O&M manuals to describe the equipment actually furnished. Do not include extraneous data for models, options, or sizes not furnished. When more than one (1) model or size of equipment type is furnished, show the information pertaining to each model, option or size.

.5 In addition to information called for in the Specifications, include the following:

- .1 Title sheet, labelled "Operating and Maintenance Instructions", and containing project name and date.
- .2 List of contents.

.3 Record Shop Drawings of all mechanical and electrical systems.

.4 Full description of entire mechanical and electrical system and operation.

.5 Address and telephone number of the Contractor and the nearest Contractor's Representative, including distributors for parts, servicing, and repairs.

.6 Detailed Specification and O&M instructions for all items of equipment provided including a preventative maintenance program.

.7 Process control/operating instructions for each component and the entire system as a whole. This shall include, but not necessarily be limited to:

.1 The Contractor's recommended step-by-step procedures for starting and stopping under normal and emergency operation. Include all specified modes of operation including recommended operation after the assembly or equipment has been in long-term storage.

.2 Control diagrams with data and information to explain operation and control of systems and specific equipment.

.3 Technical information on all alarms and monitoring devices provided with the equipment.

.4 Routine maintenance requirements including procedures and specific description of consumable items such as lubricants, filter, seals, etc. and listing Canadian sources of supply.

.5 Complete disassembly, inspection, repair and re-assembly instructions including required tolerances, fastener pre-loads, specialty tools and any other information necessary to restore equipment to correct operation.

.8 List of spare and replacement parts and consumables.

.9 List of special tools.

.10 Nameplate information including equipment number, make, size, capacity, model number, serial number and equipment tag number.

.6 Submit separately originals of all warranties and guarantees. Arrange to conform to same sequence as project Specifications.

1.4 Definitions

.1 Contractor's Representative: A Contractor's Representative is a trained serviceman empowered by the Contractor to provide:

.1 Witnessing of delivery

.2 Witnessing of equipment installation

.3 Assistance in equipment commissioning

.4 Confirmation of satisfactory equipment operation

.5 Participation in the performance testing.

1.5 Equipment Delivery

.1 Pack and crate each component to provide protection during transport, handling, and storage. The Contractor shall identify each component with durable labels or tags securely attached to each piece of equipment, crate or container.

.2 Protect polished and machined metal surfaces from corrosion and damage during shipment and storage. Protect threaded connections with threaded plugs or caps and protect open plain end pipes with caps. Pack electrical equipment and control panels to prevent scratching, access by dirt, moisture, or dust or damage to insulation, and shall cover equipment having exposed bearings and glands to exclude foreign matter. All openings in the equipment shall be covered before shipment. Sufficient lifting hooks shall be supplied for handling all crates or boxes and heavy pieces

1.6 Installation Support

.1 Provide instructions regarding the installation of the equipment. If it is found necessary, or if so directed by the Contract Administrator, attends the site to provide assistance during installation

.2 Prior to completing installation, the Contract Administrator will inform the Contractor and arrange for the attendance at the Site of the Contractor to verify successful installation.

.3 Conduct a detailed inspection of the installation including, wiring, electrical connections, controls and instrumentation, rotation direction, running clearances, lubrication, workmanship, and all other items as required to ensure successful operation of the equipment.

.4 Identify any outstanding deficiencies in the installation and provide a written report to the Contract Administrator describing such deficiencies.

.5 Deficiencies shall be rectified and the Contractor's Representative shall then re-inspect.

1.7 Equipment And Performance Verification

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

.2 The Contract Administrator will inform Contractor at least seven (7) days in advance of conducting the tests and arrange for the attendance of the Contractor. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contract Administrator.

.3 The Contractor shall conduct all necessary checks to the equipment and if necessary, advise the Contract Administrator of any further Work needed prior to confirming the equipment is ready to run.

.4 Demonstration Test: If floodway levels are high enough to provide water for pump testing, the Contractor's Representative shall 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 will be promptly undertaken.

.5 Running Test: The equipment will then be run for one (1) hour. Local controls will be satisfactorily verified by cycling the equipment through several start-stop operations. Operating parameters such as temperature, pressure, voltage, vibration, etc., will be checked to ensure that they are within the specified or the Contractor's recommended limits, whichever is more stringent.

.6 Equipment Performance Test: The equipment will be restarted and run continuously for three (3) days. During this period, as practicable, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the Contractor, and the Contract Administrator on the basis of the information contained in the Contract Documents, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.

.7 Should the initial demonstration, running test or EPTs reveal any defects, then those defects shall be promptly rectified and the demonstration, running tests, and / or performance tests will be repeated to the satisfaction of the Contract Administrator.

1.8 Quality Assurance

.1 Build motors in accordance with Canadian Standards Association (CSA) C22.2 No. 100, CSA C22.2 No. 145, National Electrical Manufacturer's Association (NEMA) Standard MG1, and to the requirements specified.

1.9 Shipment, Protection and Storage

.1 Ship, protect, and store equipment in a manner that prevents damage or premature aging.

.2 Handle motors with suitable lifting equipment.

2. PRODUCTS

2.1 Acceptable Pump and Motor Manufacturers

.1 Flygt

.2 KSB

.3 ABS

2.2 Pump Motors

.1 Heavy duty service.

.2 Squirrel cage induction type with non-hygroscopic windings. Insulation temperature rise not to exceed Class F. Insulation to be moisture resistant.

.3 For starting and torque characteristics, conform to Electrical and Electronic Manufacturers Association of Canada (EEMAC) Design B.

.4 Provide motor nameplate rated for 600 V, 60 Hz, 3-phase service unless otherwise noted.

.5 Design motors for full voltage starting and capable of running successfully when terminal voltage is from +10% to -10% of nameplate voltage. Motors with a service factor of 1.0 shall run at not more than 90% of nameplate current rating and motors with a service factor of 1.15 shall operate at not more than 100% of nameplate current rating.

.6 Provide motors capable of ten (10) evenly spaced starts per hour on a continuous basis without temperature rises which would harm insulation and windings.

.7 Design motors for semi-continuous immersion in liquid with an ambient temperature of 40°C unless higher temperatures are noted. Design casing for adequate heat rejection. Designs utilizing the circulation of the pumping liquid are not permitted.

.8 Design the pump control / monitoring system with solid modules for monitoring motor stator high temperature, high bearing temperature and moisture sensing / water intrusion into the stator housing and seal chamber.

.9 Provide sealed ball bearing type bearings with an Anti-Friction Bearings Manufacturers Association (AFBMA) B10 life of 100,000 hours.

.10 Provide 304 or 316 stainless steel hardware.

2.3 Motor Cable

.1 Supply submersible motors with cable, of a minimum length to reach the pump's control panel/starter. The motor and cable to be capable of continuous submergence under water without loss of watertight integrity to a depth of 20 m.

.2 Provide cable that contains power and ground wires, copper, of sufficient size for the service and in compliance with applicable codes.

.3 Provide cable that contains instrument leads, shielded as necessary to prevent electrical interference.

.4 Provide heavy duty cable, water tight and capable of withstanding operating loads.

.5 Seal end of cable prior to shipping to prevent ingress of moisture.

2.4 Pump and Discharge Pipe System Description

.1 Mount pumps onto seats at the bottom of vertical discharge pipes in a wet pit. The pumps are held in place by their own weight and the pumping head.

.2 Make pumps completely removable from the discharge columns from above so that entry into the wet pit is not required for inspection or service.

.3 Close-couple pump and motor to form one integrated direct drive unit.

.4 Provide the discharge pipes complete with seats and support flanges, as required to provide a long term, reliable operating interface with the pumps.

2.5 Pump Capacities and Performance

.1 Provide 2 pumps.

.1 Drive:	Constant Speed
.2 Design Point – Flow:	1 m^3/s
.3 Design Point – Head:	13 m
.4 Peak Operating Head Range:	14 to 2.0 m
.5 NPSHR not to exceed this value at pump head above 10 m:	9.5 m
.6 Maximum speed:	900 rpm

2.6 Pump Detailed Specifications

.1 Cast iron pump casing and impeller.

.2 Fabricate all exposed nuts and bolts of 304 stainless steel.

.3 Cast iron A48, impeller.

.4 Use single piece shaft.

.5 Completely isolate the shaft from the pumped liquid.

.6 Provide bearings with a minimum Anti-Friction Bearings Manufacturers Association (AFBMA) B10 bearing life of 100,000 hours minimum.

.7 For the lower bearing include a thermal sensor (RTD) of the platinum - 100 type to monitor the temperature of the thrust bearing outer race during operation.

.8 Design each pump and motor to be cooled by the passage of the pumped fluid up, about, and past the motor housing.

.9 Provide adequate length of cable to reach the junction box without splices.

.10 Make outer jacket of oil resistant chloroprene rubber and insulate the copper conductors with ethylene-propylene rubber. Make the cable abrasion resistant.

.11 Use cable rated for 750V and 90°C.

.12 Design the cable entry to be 100% watertight during immersion of up to 20 m depth, while providing sufficient strain relief to prevent the cable from pulling out when handling, installing or operating the pump.

.13 Seal the lower terminal board from the motor by an elastomer compression seal (O-ring) so that it is leakproof.

.14 In the junction box, provide a collection cavity placed so that any leakage into the junction box terminates in the cavity. Separately wire a sensor in the cavity to provide an alarm in the event of water intrusion into the cable junction box.

.15 Provide a pump control status monitoring system for each pump. The motor starters, disconnect switches, and other power ancillaries will be provided by Section 16000.

.16 Design the pump control/monitoring system with solid state modules for monitoring motor stator high temperature, high bearing temperature and moisture sensing/water intrusion into the stator housing and cable connection housing.

.17 Control system shall have capabilities equal to the Flygt 'MAS' system.

.18 For each pump control/monitoring system provide 25 m of control wiring and a junction box to connect between the pump and the control enclosure.

.19 Provide an O-ring seal at the bottom of the pump inlet so that the weight of the pump unit effectively forms a seal between pump and discharge column.

2.7 Factory Tests & Factory Performance Testing

.1 Perform the following inspections and tests on each pump before shipment from the factory. Include the test results in the O&M Manuals.

.1 Test motor and cable insulation for defects.

.2 Prior to submergence, dry run the pump to establish correct rotation and mechanical integrity.

.3 Submerge the pump and run for thirty (30) minutes.

.4 Simulate the head conditions at 14.0 m and at 2 m.

.5 Develop a certified test curve (per Hydraulic Institute Class A standards) showing the performance of the pump.

.6 Repeat the insulation tests after the operational test.

.7 Document the tests and submit the results.

2.8 Pump Discharge Pipes

.1 Supply two (2) Schedule 10 304 stainless steel discharge pipes and integral pump support plates as specified, as shown on the drawings, and to meet the requirements of the pump.

.2 Provide stiffening and guiding webs at the pump support seat to ensure concentric positioning of pump within the discharge column.

.3 Use ASTM A312 Gr. TP304L butt welded, material for the entire pipe and pump support plate assembly.

.4 All welding shall be done by qualified welders, under CSA Specification W47 in accordance with the requirements of CSA W59.

.5 The following processes are approved for pipe fabrication, assembly and erection:

.1 Gas Tungsten Arc (GTAW) – manual or automatic welding, inert gas shielding.
.2 Gas Metal Arc (GMAW) – semi-automatic welding, inert gas shielding
.3 Plasma Arc (PAW) – automatic welding only for thickness above 3/8”, neutral (non-alloying) flux shielding.
.4 Submerged Arc (SAW) – automatic welding only for thickness above 3/8”, neutral (non-alloying) flux shielding.

Inert gas shielding shall consist of Argon, Helium or a mixture of these two. Mixtures or Argon and / or Helium with not more than 5% by volume of H_2, O_2 and/or CO_2 shall be used only with Engineer’s prior approval.

.6 Prior to manufacture, the Contractor shall submit for review detailed pump discharge pipe fabrication drawings and welding procedures stamped by a Professional Engineer as being suitable for this application for review.

END OF SECTION

1. GENERAL

1.1 Intent

.1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.

.2 In general work in this Division includes:

- Installation of pump systems.
- Electrical room ventilation system.

.3 Drawings are diagrammatic. They establish scope, material and installation quality and are not detailed installation instructions.

.4 Follow Manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.5 General Conditions and Supplementary Conditions shall apply to work in this system.

.6 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the City of Winnipeg (City). Uncrate equipment, move in place, install complete; start-up and test.

.7 'Provide' shall mean; "supply and install'.

1.2 Co-ordination of Work

.1 Make reference to electrical, mechanical, structural and architectural Drawings when setting out Work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided. Jointly resolve all conflicts on-site before fabricating or installing any materials or equipment.

.2 Where dimensional details are required, coordinate with the applicable architectural and structural Drawings.

1.3 Quality of Work

.1 All Work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates. Spot checks will be made by the Contract Administrator.

.2 Work which does not conform to standards accepted by the Contract Administrator and the trade may be rejected by the Contract Administrator.

1.4 Operating and Maintenance Manuals

.1 Combine Division 11, 15 and 16 Operating and Maintenance manual information into one binder with appropriate separation sheets and tags as required.

END OF SECTION

INSTALL PUMPS

1. GENERAL

1.1 Scope

.1 Install Pump System specified in Section 11000.

.2 Section 15010 shall apply to work in this section.

2. EXECUTION

2.1 Pump System – Install

.1 Handle and transport the pumps according to the manufacturer's recommendations.

.2 Install the pumps according to the manufacturer's recommendations.

.3 Coordinate with Section 16 to ensure the integral pump cable and cable support system are securely installed to avoid movement when the pump is in operation and that this system does not rub against adjacent supports, walls, etc. Provide stainless bolts and anchors as required to install the pump cable support system.

.4 Install and secure the pump hoisting cable system as per the pump manufacturer's recommendations and as shown on the drawings.

2.2 Pump System Testing

.1 Co-ordinate all parties involved in scheduling, planning and executing the pump test specified in Section 11000. This shall include as required:

- City of Winnipeg
- KGS Group
- Electrical Contractor
- Equipment suppliers including, pump, electrical, control and other supplies as required to ensure testing can be completed expeditiously and that issues arising during testing can be addressed as they arise.

.2 Assist the pump supplier in carrying out the flow tests specified in Section 11000. This may involve the following activities:

.1 lifting the pumps out of the FPS to permit the supplier to inspect the pump and make any necessary adjustments.

.2 Provide a closure panel at the FPS outlet to contain water used for testing. When testing has been completed, remove this panel and release the test water to the floodway.

.3 Co-ordinate the pump testing schedule and make arrangements through the Contract Administrator for the City to provide water for pump testing via the FPS inlet pipe to a level of 226.3 m.

.6 Timing of this test will be determined by the Contract Administrator. The Contractor will be responsible for any installation related issues or deficiencies that may arise during this testing program.

END OF SECTION

1. GENERAL

1.1 Scope

.1 Supply and install an electrical room ventilation system as shown on the drawings and as specified.

.2 Section 15010 shall apply to work in this section.

1.2 References

.1 AMCA 210, Laboratory Methods of Testing Fans for Rating Purposes

.2 National Electrical Code (NEC)

.3 National Electrical Manufacturers Association (NEMA) MG1, Motors and Generators

.4 National Fire Protection Association (NFPA) 70, National Fire Protection Code

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), Heating, Ventilation, and Air Conditioning (HVAC) Duct Construction Standards – Metal and Flexible

2. PRODUCTS

2.1 Supply Fan

.1 Fan shall be "Howden Buffalo" baby vent set, size B, 1/3 H.P., 115/1/60, 3450 RPM motor.

2.2 Quality Assurance

.1 Fabricate in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) duct manuals and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) handbooks.

2.3 Material

.1 Sealant: Water resistant, fire resistive, compatible with mating materials.

2.4 Flexible Connections

.1 Fabricate of ULC approved neoprene coated flameproof glass fabric approximately 150 mm (6 in.) wide tightly crimped into metal edging strip and attached to ducting and equipment by screws or bolts at 150 mm (6 in.) intervals. Flexible connection airtight at 500 Pa (2 in wg).

.2 Install on fan inlet connection.

2.5 Ductwork

.1 Provide ductwork to conform to SMACNA Standards for low pressure ductwork.

2.6 Louvres

.1 Provide two (2) 450 mm x 300 mm "E.H. Price" K609HP, fixed blade c/w bird screen or approved equal.

3.0 EXECUTION

3.1 Installation

.1 Rigidly construct metal ducts with joints mechanically, substantially airtight, braced and stiffened so as not to rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled. Seal duct seams watertight with mastic or low velocity duct sealant.

END OF SECTION

DIVISION 16 - ELECTRICAL

PART 1 GENERAL

1.1 Related Sections

.1 This Section covers items common to Sections of Division 16.

1.2 Codes and Standards

.1 Do complete installation in accordance with the current edition of the Canadian Electrical Code (CSA C22.1) except where specified otherwise.

.2 Do overhead and underground systems in accordance with the current edition of CSA C22.3 No.1 except where specified otherwise.

.3 Perform all work in accordance with local codes and bylaws.

1.3 Care, Operation and Start-up

.1 Instruct Contract Administrator and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 Voltage Ratings

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 Permits, Fees and Inspection

.1 Submit to Electrical Safety Authority and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Contract Administrator will provide drawings and specifications required by Electrical Safety Authority and Supply Authority at no cost.

.4 Notify Contract Administrator of changes required by Electrical Safety Authority prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Safety Authority on completion of work to Contract Administrator.

1.6 Measurement and Payment

.1 The lump sum price in Form B applies to all work listed within these specifications and on the drawings to provide a complete and operational electrical distribution and control system to meet the operational intent of the facility.

.2 The electrical portion of this contract shall be submitted on Form B as a lump sum. Payment for the work will be based on percentage estimation of progress. The Contract Administrator shall review the percentage of work complete and review the estimated Work with the Contractor prior to submitting the progress payment to the City. Progress estimates include time required for training.

1.7 Materials and Equipment

.1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.2 Factory assemble control panels and component assemblies.

1.8 Electric Motors, Equipment and Controls

.1 Provide all power and control wiring and connections including mechanical control wiring as specified on mechanical and electrical drawings.

1.9 Finishes

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.10 Equipment Identification

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self tapping screws.

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

.2 Utilize nameplate types as required to completely identify unit.

.3 Reduced Voltage Starter Units: Indicate RVS identification number, and fed from identification number "RVS-1/Fed from _____".

.4 RVS Feeder Units (eg. to motors): Indicate motor identification name and feeder "Pump P-1/Fed from RVS-1".

.5 Transformer: Indicate feeder circuit identification number, transformer identification number "TR-1/Fed from _____/Feeds _____".

.6 Lighting Panels, Power Panels, Instrument Power Panels and Feeder Units to Panels: Indicate panel identification name, and where fed from "Panel PP-1/Fed from TR-1".

.7 Field Operator Stations (eg. start/stop): Indicate station number, title, and where appropriate device controls.

.8 Control devices (eg. remote thermostats): Indicate equipment number of unit being controlled.

.9 Light switches and convenience receptacles: Indicate panel and circuit number.

.10 Co-ordinate names of equipment with Mechanical Division to ensure that identical names are used.

.11 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.12 Allow for average of twenty-five (25) letters per nameplate.

.13 Identification to be English.

.14 Identify equipment with Size 3 labels engraved with equipment tag.

1.11 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, using Electrovert Type Z cable markers (or equal) on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use number coded wires in control cables, matched throughout system. Identify conductors with permanent indelible identifying markings, numbered on both ends.

.5 Use number coded pairs in instrumentation cables, matched throughout system. Pairs shall be also color coded black and white for polarity indication. Identify conductor pairs with permanent indelible identifying markings, at both ends.

1.12 Wiring Terminations

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.13 Manufacturers and CSA Labels

.1 Visible and legible, after equipment is installed.

1.14 Warning Signs

.1 As specified and to meet requirements of The City and Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

1.15 Single Line Electrical Diagrams

.1 Provide single line electrical diagrams under plexiglass as follows:

.1 Electrical distribution system: locate in main electrical room.

.2 Drawings: 280 x 460 mm minimum size.

1.16 Location of Outlets

.1 Locate outlets in accordance with Section 16132 – Outlet Boxes, Conduit Boxes and Fittings, and as shown on the drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

1.17 Mounting Heights

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 In mechanical rooms: 600 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: 1500 mm.

1.18 Load Balance

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.19 Conduit and Cable Installation

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: pvc, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.20 Field Quality Control

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba. Submit test results to Contract Administrator.

.3 Conduct and pay for following tests:

.1 Point to Point wire continuity test for all conductors.

.2 Power distribution system including phasing, voltage, grounding and load balancing.

.3 Circuits originating from branch distribution panels.

.4 Lighting and its control.

.5 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.6 Systems: fire alarm system

.7 Test resistance to ground of the completed grounding electrode.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.

.1 Megger 600 V circuits, feeders and equipment with a 1000 V instrument.

.2 Check resistance to ground before energizing.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Contract Administrator's review.

1.21 Co-ordination of Protective Devices

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

1.22 Instruction Manuals

.1 The Contractor shall provide the City of Winnipeg with four (4) copies of maintenance and operating manuals showing:

.1 Service Instructions: Including a list of spare parts and replacement parts and the names and addresses of all suppliers.

.2 Maintenance Instructions.

.3 Installation Instructions.

.4 Operating Instructions.

.5 Electrical Schematics.

1.23 As-Built Drawings

.1 The Contractor shall provide two sets of record drawings bearing notations of all changes and variations from the originals. One set shall remain on site to assist in operation until the final as-builts are available. One set shall be delivered to the Contract Administrator.

.1 The accuracy of these drawings shall be the responsibility of the Contractor, who shall bear all expenses of corrections thereto.

1.24 Training

.1 The Contractor shall provide two separate complete days of training on the operation of the electrical and control equipment. These training days are to be co-ordinated with the city a minimum of two weeks in advance.

1.25 Scope of Work

.1 Supply and install all lighting, conduit, receptacles, panels etc. as indicated on the drawings.

.2 Supply and Install electrical power and controls wiring as indicated on the drawings.

.3 Install electrical power/control cables from flood pumps to splitter boxes. Cable supplied by pump manufacturer.

.4 Supply and Install shop fabricated panels produced by a CSA certified panel shop for the Level Control Panel, Pump Field Junction Panels (JB-P1 & JB-P2) and Power Monitoring Panel (PL-CP).

.5 Provide pre-commissioning tests (in the dry) as follows:

.1 Pump rotation.

.2 Soft start setup.

.3 Arrange for City WWD to setup pump level controls.

.4 Test out all alarms locally and together with WWD alarms out to the City's SCADA.

.6 Commissioning tests (in the wet, Refer to Section 11000 for details)

.1 Provide all services required to prove out the pumping system in the wet.

1.26 Electrical Service

.1 The City will arrange and pay for Manitoba Hydro to provide electrical service up to hydro supplied pad mount transformer. All cabling from the secondary side terminals is the responsibility of the Contractor. A continuous wireway from the lockable metering enclosure to the CT's must be installed by the Contractor for Manitoba Hydro to install it's metering equipment. The Contractor is to coordinate with Manitoba Hydro for this work.

1.27 Telephone Service

.1 Telephone service is to be installed by MTS. Contractor is responsible for coordinating telephone service installation with MTS.

PART 2 PRODUCTS

2.1 Not Used

PART 3 EXECUTION

3.1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 16010 - Electrical General Requirements.

PART 2 PRODUCTS

2.1 Markers

.1 Cable marker strip at depth indicated.

PART 3 EXECUTION

3.1 Direct Burial Of Cables

.1 After sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm horizontal separation between low and high voltage cables.

.3 Installation configuration as per Canadian Electrical Code (CSA C22.1).

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.

.6 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 GENERAL

1.1 Description

.1 Supply and install a complete grounding system. Securely and adequately ground all components of the electrical system in accordance with the requirements of all related sections in the current edition of the Canadian Electrical Code (CSA C22.1) (as adopted by the Province of Manitoba).

.2 The system to consist of cables, ground rods, supports, and all necessary materials and inter-connections to provide a complete system. Measured resistance to ground of the network shall not exceed 5 ohms.

PART 2 PRODUCTS

2.1 Equipment

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as required.

.3 Rod electrodes: copper clad 19 mm dia by 3 m long.

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

.7 Insulated grounding conductors to be stranded copper RW90 complete with a green jacket.

PART 3 EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 All bolted connections must be accessible.

.7 Soldered joints not permitted.

.8 Include a separate green ground wire in all power conduits including branch circuit wiring sized to Table 16 of the current edition of the Canadian Electrical Code.

.9 Expansion joints and telescoping sections of raceways shall be bonded using jumper cables as per the current edition of the Canadian Electrical Code.

.10 Use Burndy compression connectors or approved equal for all grounding splices and terminations unless otherwise shown on the Drawings. For bolted ground connections use Burndy Engineering Company's "Durium" or approved equal hardware.

.11 Connect all transformer neutrals to the main building ground wire, using compression terminations.

.12 Install rigid conduit sleeves c/w bushings where ground wires pass through concrete slabs.

.13 Use mechanical connectors for grounding connections to equipment provided with lugs.

.14 Connect building structural steel and metal siding to ground by welding copper to steel.

.15 Ground secondary service pedestals.

3.2 Electrodes

.1 Install rod electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 System and Circuit Grounding

.1 Install system and circuit grounding connections to neutral of secondary 120 V system.

3.4 Equipment Grounding

.1 All frames and metallic enclosures of all electrical equipment and electrically operated equipment shall be grounded through the conduit system or/and via a ground wire.

.2 All transformers, switchgear, motor control centres, panelboards and splitters fed from the main distribution center shall be grounded by grounding conductors sized in accordance with the current edition of the Canadian Electrical Code. The ground wire shall be terminated at each end with an appropriate grounding lug which shall be connected to the equipment ground bus.

.3 All sub panels such as lighting panels, local distribution panels, etc., shall be grounded with a green ground wire run back to the panel from which it is fed. The ground conductor shall be sized according to the current edition of the Canadian Electrical Code.

.4 All main distribution centres, switchgear, motor control centres, and all panels requiring equipment grounds shall contain a ground bus of adequate size, and tapped for lugs for the ground wire required.

.5 All motors shall be grounded by means of an adequately sized ground wire contained within the feeder conduit.

.6 Ground buried corrugated metal pipe to existing ground grid as shown on the drawings.

3.5 Communication Systems

.1 Install grounding connections for telephone systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

3.6 Field Quality Control

.1 Perform tests in accordance with Section 16010- Electrical General Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

PART 1 GENERAL

PART 2 PRODUCTS

2.1 Support Channels

.1 U shape, size 41 x 41 mm, 12 gauge, solid configuration.

.2 Surface mounted or suspended.

PART 3 EXECUTION

3.1 Installation

.1 Secure equipment to solid concrete or steel structures.

.2 Secure equipment to hollow or solid masonry with lead anchors and to toggle bolts.

.3 Secure equipment to poured concrete with expandable inserts.

.4 Secure equipment to wood trusses with ¼" lag screws.

.5 Support equipment, armoured cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.7 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.8 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.9 Fasten exposed armoured cable to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.10 For surface mounting of two or more conduits use channels at spacing as per Rule 12-1010(1) of the current edition of the Canadian Electrical Code.

.11 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.12 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.13 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.14 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.15 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

PART 1 GENERAL

1.1 Related Sections

.1 Section 16151 - Wire and Box Connectors - 0 - 1000 V.

1.2 References

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 Product Data

.1 Submit product data.

PART 2 PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 1 kV TECK90 Power Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated (#12 AWG minimum where not indicated).

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material. Black in colour.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for TECK cable.

2.3 600 V TECK90 Control Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: #14 AWG copper, number coded.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material. Black in colour.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for TECK cable.

2.4 300 V Instrument Cable - Armoured

.1 Conductors: #16 AWG, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

.2 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.3 Twisted pairs/triads cabled with staggered lays.

.4 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.5 Type RW90 Conductor

.1 In accordance with CSA C22.2 No.38

.2 Circuit conductors shall be concentric stranded soft copper, size as indicated (#12 AWG minimum where not indicated).

.3 Insulation to be chemically cross-lined thermosetting polyethylene rated type RW90 XLP, 600V

.4 Suitable for installation in temperatures down to minus 40 °C.

.5 90 °C conductor operating temperature.

2.6 Type TEW Conductor

.1 Circuit conductors shall be stranded soft copper, as per ASTM B-3 and B-8.

.2 Insulation to be thermoplastic compound meeting the requirements of Canadian Standards Association Type TEW, per CSA 22.2 Part 1, No.127.

.3 Isulation rated to 600 Volts.

.4 Suitable for installation in temperatures down to minus 40 °C

.5 105 °C conductor operating temperature.

.6 Use #16 AWG for PLC cabinet internal wiring.

PART 3 EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 16133 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 Installation of TECK Cable 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 16151- Wire and Box Connectors - 0 - 1000 V.

3.3 Installation of Control Cables

.1 Install control cables in cable troughs where quantity warrants it.

.2 Ground control cable shield at one end only.

END OF SECTION

SPLITTERS, JUNCTIONS, PULL BOXES AND CABINETS

PART 1 GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data for cabinets.

PART 2 PRODUCTS

2.1 Splitters

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 Junction and Pull Boxes

.1 PVC construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

PART 3 EXECUTION

3.1 Splitter Installation

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 Junction and Pull Boxes Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Current edition of the Canadian Electrical Code (CSA C22.1).

PART 2 PRODUCTS

2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Conduit Boxes

.1 Cast FS or FD copper free aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles for rigid conduit or Teck Cable.

.2 PVC boxes for PVC conduit.

2.3 Fittings - General

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 EXECUTION

3.1 Installation

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of openings in boxes for conduit or armoured cable connections. Reducing washers are not allowed.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.

.2 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.

1.2 Preferences

.1 In general power and control wiring shall be by TECK or armoured cable. Where suitable, PVC conduit may be used in wet areas and RGS may be used in dry areas.

PART 2 PRODUCTS

2.1 Conduits

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel

.2 Rigid pvc conduit: to CSA C22.2 No. 211.2.

2.2 Conduit Fastenings

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 0.75 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 Conduit Fittings

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90º bends are required for 25 mm and larger conduits.

2.4 Expansion Fittings for Rigid Conduit

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 Fish Cord

.1 Polypropylene.

PART 3 EXECUTION

3.1 Installation

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Surface mount conduits.

.3 Minimum conduit size for lighting and power circuits: 19 mm.

.4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.5 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.6 Install fish cord in empty conduits.

.7 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.8 Dry conduits out before installing wire.

.9 Connect conduit to equipment securely to maintain continuity for the purpose of bonding to ground.

.10 Provide for expansion and contraction of the conduit system.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended surface channels.

.4 Do not pass conduits through structural members except as indicated.

3.3 Concealed Conduits

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

3.4 Conduits in Cast-in-place Concrete

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 Conduits Underground

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

END OF SECTION

PART 1 GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings and product data.

PART 2 PRODUCTS

2.1 Switches

.1 15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches as required.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver cadmium oxide contacts.

.3 Fully enclosed with urea or melamine molding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.3 Toggle operated fully rated for fluorescent lamps and resistance loads, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 1200 Series or equivalent.

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground industrial grade, with following features:

.1 Brown urea molded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground industrial grade, with following features:

.1 Brown urea molded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 5252 or equivalent.

2.3 Cover Plates

.1 Stainless steel or pvc cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Weatherproof double lift spring-loaded stainless steel or pvc cover plates, complete with gaskets for duplex receptacles as indicated on the drawings.

.6 Weatherproof spring-loaded stainless steel or pvc cover plates, complete with gaskets for single receptacles or switches as indicated on the drawings.

PART 3 EXECUTION

3.1 Installation

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 16010- Electrical General Requirements or as indicated.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 16010- Electrical General Requirements or as indicated.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount lighting fixture receptacles local to fixtures.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Most recent CSA C22.2No.65-1956Wire Connectors.

.2 Most recent EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

PART 2 PRODUCTS

2.1 Materials

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armored cable, flexible conduit, non-metallic sheathed cable as required.

PART 3 EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer.

.2 Install fixture type connectors and tighten. Replace Insulating cap.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 16010 - Electrical General Requirements.

1.2 References

.1 NEMA ICS 2, Industrial Controls and Systems

.2 CSA 22.2 No.14-95, Industrial Control Equipment

1.3 Extra Materials

.1 Provide maintenance materials.

.2 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.

.2 3 contacts, movable.

.3 1 contacts, auxiliary.

.4 1 control transformer.

.5 1 operating coil.

.6 2 fuses.

.7 10% indicating lamp bulbs used.

PART 2 PRODUCTS

2.1 Manual Motor Starters

.1 Nema rated single and three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One or three overload heater(s) as required, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch: Heavy duty oil tight labelled as indicated.

.2 Indicating light: Heavy duty LED oil tight type and colour as indicated.

.3 Locking tab to permit padlocking in "OFF" position.

2.2 Full Voltage Magnetic Starters

.1 Nema rated magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fuse or circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Selector switches: Heavy duty oil tight labelled as indicated.

.2 Indicating lights: Heavy LED duty oil tight type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.3 Control Transformer

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.4 Finishes

.1 Apply finishes to enclosure in accordance with Section 16010 - Electrical General Requirements.

2.5 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Manual starter designation label, white plate, black letters, size 1, engraved.

.3 Magnetic starter designation label, white plate, black letters, size 1, engraved.

PART 3 EXECUTION

3.1 Installation

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSAC9-M1981 (R1997), Dry-Type Transformers.

1.2 Source Quality Control

.1 Submit to Contract Administrator 6 copies of standard factory test certificates of each transformer and type test of each transformer in accordance with CSAC9.

1.3 Shop Drawings

.1 Submit shop drawings.

.2 Include:

.1 Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.

.2 Technical data:

.1 kVA rating.

.2 Primary and secondary voltages.

.3 Frequency.

.4 Number of phases.

.5 Polarity or angular displacement.

.6 Full load efficiency.

.7 Regulation at unity pf.

.8 BIL.

.9 Insulation type.

.10 Sound rating.

1.4 Closeout Submittals

.1 Provide operation and maintenance data for dry type transformers for incorporation into O&M manual.

.2 Operation and maintenance instructions to include:

.1 Tap changing.

.2 Recommended environmental conditions.

.3 Recommended periodic inspection and maintenance.

PART 2 PRODUCTS

2.1 Materials

.1 Dry-type transformers: to CSAC9.

.2 Bushings: to EEMACGL1-3.

2.2 Transformer Characteristics

.1 Type: ANN.

.2 Rating: As specified on drawings.

.3 220 ºC insulation system class, 115 ºC temperature rise.

.4 Impedance: 4 - 6 %.

.5 Primary winding: 600 V, delta, BIL 10 kV.

.6 Secondary winding: Voltage and winding connection as specified on drawing.

.7 No load losses not to exceed 1 % of kVA rating.

.8 Full load losses not to exceed 6 % of kVA rating.

.9 Sound rating: 50 dB maximum.

2.3 Enclosure

.1 Heavy duty ventilated NEMA type 1, Fabricated from sheet steel.

.2 Bolted removable panels for access to access separated primary and secondary terminals.

.3 Conductor entry: Knockouts

.4 Designed for universal floor, wall mounting or trapeze hung.

.5 Indoor, ventilated, self cooled type. Temperature of exposed metal parts not to exceed 90ºC rise.

2.4 Voltage Taps

.1 Three phase units:

.1 Units rated to 15 kVA, 1 ± 5 % FCAN & 1 ± 5 % FCBN.

.2 Units rated greater than 15 kVA, 2 ± 2.5 % FCAN & 2 ± 2.5 % FCBN.

.2 Single phase units:

.1 2-2.5 % FCAN & 2-2.5% FCBN.

2.5 Windings

.1 High grade, non-aging grain oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum flux densities shall be substantially below the saturation point.

.2 Core volume shall allow for efficient transformer operation at 10 % above the nominal voltage.

.3 Core laminations shall be tightly clamped and compressed.

.4 Coils shall be wound of electrical grade copper with continuous wound construction.

.5 Core and coil to be vacuum pressure impregnated with polyester varnish or epoxy resin.

.6 The assembly shall be mounted on vibration absorbing pads.

2.6 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Equipment nameplate size 7.

PART 3 EXECUTION

3.1 Installation

.1 Wall mount dry type transformers.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformer in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

.6 Set and secure transformers in place, rigid plumb and square.

.7 Connect primary terminals to high voltage circuit.

.8 Connect secondary terminals to secondary circuit.

.9 Energize transformers and check secondary no-load voltage.

.10 Adjust primary taps as necessary to produce rated secondary voltage at no-load.

.11 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.

.12 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The moulded case circuit breakers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:

.1 CSA C22.2 No. 5.1, Moulded Case Circuit Breakers

1.2 Regulatory Requirements

.1 Circuit breakers shall be CSA certified.

PART 2 PRODUCTS

2.1 Moulded Case Circuit Breakers

.1 Moulded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics and shall be Cutler-Hammer type Series C or approved equal.

.2 Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handler position. Contacts shall be nonwelding silver alloy, and arc extinguishing shall be accomplished by means of DE-ION arc chutes.

.3 Circuit breakers to have minimum symmetrical interrupting capacity rating as indicated on the drawings.

.4 Where indicated, circuit breakers shall be current limiting.

.5 Circuit breakers 400 ampere frame and below shall be Cutler-Hammer type Westinghouse Series C with thermal-magnetic trip units and inverse time-current characteristics.

.6 Circuit breakers identified as MCP will operate on the magnetic principle with a current sensing element in each pole.

.7 Circuit breakers 600 ampere through 2500 ampere frame shall be Cutler-Hammer type Westinghouse Series C with microprocessor-based RMS sensing trip units or approved equal.

.1 Each moulded case circuit breaker microprocessor-based tripping system shall consist of three current transformers, and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analysing the secondary current signals received from the circuit breaker current transformers and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.

.2 Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed. Rating plugs shall be interlocked such that a breaker cannot be closed and latched with the rating plug removed.

.3 The microprocessor-based trip unit shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.

.4 When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override. Internal ground fault protection adjustable pick-up ratings shall not exceed 1200 amperes.

.5 Breakers shall have built-in test points for testing the long time delay, instantaneous, and ground fault functions of the breaker by means of a 120 Volt operated test set. Provide one test set capable of testing all breakers 600 ampere frame and above.

.6 System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

.1 Adjustable long time pick-up and delay.

.2 Adjustable short time pick-up and delay.

.3 Adjustable instantaneous pick-up.

.7 Circuit Breakers shall be Cutler-Hammer type Westinghouse Series C circuit breakers, microprocessor-based RMS sensing trip units type Digitrip RMS 310 LSI or LSIG trip units or approved equal.

.8 Accessories:

.1 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

.9 Enclosure:

.1 All enclosed circuit breakers shall have EEMAC 1 general purpose enclosures.

.2 All enclosed circuit breakers shall have metal nameplates, front cover mounted, that contain a permanent record of catalog number and maximum rating. Provide handle mechanisms that are padlockable in the “OFF” position.

PART 3 EXECUTION

3.1 Factory Testing

.1 Standard factory tests shall be preformed on the equipment under this section. All tests shall be in accordance with the latest version of EEMAC and CA standard.

3.2 Installation

.1 The Contractor shall install all equipment per the manufacturers recommendations and the contract drawings.

3.3 Field Settings

.1 The Contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operating condition. The settings shall be in accordance with the drawings.

END OF SECTION

PART 1 GENERAL

PART 2 PRODUCTS

2.1 Disconnect Switches

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure as required on the drawings sized as indicated.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated.

.5 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 EXECUTION

3.1 Installation

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 CSA C22.2 No.29 Panelboards and Enclosed Panelboards.

1.2 Shop Drawings

.1 Submit shop drawings.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 PRODUCTS

2.1 Panelboards

.1 Panelboards: Product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: Bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.

.3 600 V panelboards: Bus and breakers rated for 25,000 A (symmetrical) interrupting capacity or as indicated.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: tin plated copper mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Two keys for each panelboard and key panelboards alike.

.7 Tin plated copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

2.2 Breakers

.1 Breakers: to Section 16412- Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to City of Winnipeg.

2.3 Secondary Surge Arrester

.1 Able to withstand a maximum surge current of 40 kA per phase.

.2 SCCR Rating of 200 kA

.3 Acceptable Product: Square D Part No SDSA3650

2.4 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 EXECUTION

3.1 Installation

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 16010 - Electrical General Requirements or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 GENERAL

1.1 Scope

.1 This specification shall apply to the materials, design, fabrication, inspection, and testing of 600V Reduced Voltage Starters (RVS)

.2 Detailed specifications on the RVS shall be as indicated in this specification, drawings and attachments. In case of a conflict between the various specifications, the vendor shall contact the Purchaser for clarification. The RVS shall be manufactured by Benshaw.

1.2 Reference Documents

.1 The RVS shall be designed, manufactured and tested in accordance with the latest applicable standards of CSA, NEMA, ANSI and UL, including but not limited to:

.1 CSA C22.2 No. 14-M91—Industrial Control Equipment

.2 NEMA ICS7—Industrial Control and Systems Adjustable Frequency Drives

.3 NEMA MG1—Motors and Generators

.4 NEMA ICS 7.1—Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Frequency Drives

.2 In all cases where more than one regulation, code, standard or specification applies to the same conditions, the most stringent one shall apply. Conflicts among any of the provisions of these listed codes, standards or specifications shall be referred to the Purchaser for resolution.

1.3 Design

.1 General

.1 All RVS will be fed from a CDP provided by others and protected by Breakers. Vendor shall indicate recommended breaker size.

.2 The RVS shall consist of a disconnect, logic board, keypad, SCRs, and bypass contactors for up to speed paralleling and full voltage starting.

.3 The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs, and SCR gate firing output circuits. The logic board shall be identical for all ampere ratings and voltage classes specified.

.2 Enclosure

.1 NEMA 12 Gasketted. The RVS shall have complete front accessibility with easily removable assemblies.

.2 All RVS shall be suitable for mounting back to wall.

.3 Lamacoid nameplates shall be permanently attached with screws.

.4 The enclosure shall have appropriate warning labels indicating “CAUTION MULTIPLE CONTROL POWER SOURCES”

.5 Nameplates shall give the equipment tag number and the service description.

.6 A panel mounted non-resetable elapsed-time meter to measure operating hours with a minimum 6 digits display.

.3 Ratings

.1 The RVS shall be designed for heavy-duty applications and in accordance with applicable datasheets.

.2 The RVS shall operate normally with incoming voltage and frequency of 600V 60 Hz ±10% and have an overload capability of 125% continuous, 500% for 60 seconds and 600% for 30 seconds

.3 The RVS shall consist of six SCR rated for a minimum of 1600V peak inverse voltage and sized to withstand starting circuits of 500% for 60 seconds.

.4 Operating Conditions: Suitable for 0°C to 40°C and 5% to 95% relative humidity.

.5 The RVS shall be capable of starting when fed from temporary diesel generator (nominal size of 500 KVA).

.6 Drive rated for a minimum fault current of 22kA Sym. I.C.

.4 Protection

.1 Motor overload protection shall be two staged based upon an inverse time algorithm, one overload protection characteristic for starting and another for running. The overload characteristics shall be selectable by programming between Classes 5, 10, 20 and 30.

.2 Motor protection in the by-pass mode shall be provided by bimetallic overloads.

.3 Overload resets shall be mechanical pushbuttons from outside the enclosure and be capable of being electrically or automatically reset upon a fault condition.

.4 The SCR shall be complete with snubber networks to prevent false firing due to dV/dT effects.

.5 The RVS shall be capable of being setup and tested without a motor connected.

.6 Over-temperature protection shall be provided on the heat sink and the control board.

.7 Phase Current Imbalance Protection: Trip level: 5-30% of motor FLA between any two phases and 1-20 second delay

.8 Overcurrent Protection: Trip level:50-300 of motor FLA and 1-20 second delay

.9 Load Loss Trip Protection: Under current trip level: 10-90% of motor FLA and 1-60 second delay

.10 Coast down Lockout Timer: 1-60 minutes

.11 Starts-Per-Hour Lockout Timer: Range: 1-10 successful starts per hour. Time between starts: 1-60 minutes between start attempts

.5 Adjustments and Configurations

.1 Acceleration adjustments shall be programmable and shall be capable of dual ramp settings with the following ranges:

- Programmable Ramp Types: Voltage Ramp (VR) or Current Ramp (CR)

- Starting Torque: 0-100% of line voltage (VR) or 0-600% of motor FLA (CR)
- Ramp Time: 1-120 seconds
- Current Limit: 200-600% (VR or CR).

.2 Deceleration adjustments shall be programmable with the following ranges:

- Begin Deceleration Level: 0-100% of line voltage
- Stop Level: 0-1% less than Begin Deceleration Level
- Deceleration Time: 1-60 seconds

.3 The RVS shall be capable of being programmed that in the event of a fault, the motor either coasts to stop or decelerates according to the deceleration adjustment levels.

.6 Interface

.1 The operator interface terminal shall have an alphanumeric, high resolution, high brightness LCD display, door mounted and complete with the following status indicators:

- Control “Power On”
- Full Voltage “At Speed”
- Shorted SCR
- Phase loss
- Shunt trip
- Overload
- Over Temperature
- Overcurrent

.2 The operator interface terminal shall allow complete control of the RVS and modification of adjustments and configuration parameters. All electrical values, parameters, application and activity function access, faults, local control shall be in plain English. .

.3 The following monitoring values shall be available when in the operating mode:

- Phase currents
- Power factor
- Torque
- Remaining thermal capacity
- Elapse time
- Run cycle counter
- Lockout time values
- Fault codes
- Fault history complete with time and date stamps for the last three faults

.4 A reset key will allow a parameter to return the existing value if adjustment is not required and the value is displayed.

.5 The RVS shall have the following door mounted pilot light indicators (LED or neon type, colour as indicated), selector switches and push bottons:

- Running- Bypass Contactor Indicating Light (Green)
- Overload – Bypass Contactor Indicating Light (Yellow)
- Bypass Contactor -Overload Reset Pushbutton
- Soft Starter/Off/Bypass Contactor Selector Switch

.6 The RVS shall have Modbus (2 wire - multidrop) interface for remote interrogation by DCS. Vendor shall indicate all drive parameters that are accessible from this interface

.7 Control Systems - Analog and Digital I/O

.1 RVS shall have a minimum of 3 dry programmable relay outputs used to indicate:

- Fault (O/P)
- Run (O/P)
- Ready (O/P)

.2 The control power for the digital outputs shall be 120 VAC and be derived from the RVS control power transformer.

1.4 Testing

.1 Factory Testing

.1 The manufacturer's standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA and NEMA standards. Results from the tests shall be provided

1.5 Marking

.1 Shipping crates shall be clearly identified with the project title, equipment tag number and the purchase order number.

1.6 Handling

.1 The Supplier shall recommend handling and installation requirements and ship the equipment accordingly.

.2 One copy of assembly drawings and operating instructions shall accompany the shipment.

1.7 Submittal Requirements

.1 Documentation submittal shall be in accordance with the drawings and data submittal requirements schedule. Drawings shall be in SI units. If imperial units are used as well, they shall be shown in parenthesis after the SI units. In case of conflict between the two, SI units shall be considered to be correct.

.2 Equipment tag number, purchase order number and project name shall be shown on all Supplier supplied drawings. Data shall be located close to the title block.

.3 All drawings and data shall be submitted in a form that is easily reproduced. All data and drawings shall be submitted in both paper and electronic form. Final drawings are all required to be as-built.

.4 Review or approval of Supplier's drawings, design calculations and other documentation does not relieve Supplier of any responsibility for correctness of such drawings, calculations or other documentation.

.5 The following information shall be submitted to the Contract Administrator for approval:

- Master Drawing Index

- Dimensioned Front view elevation
- Dimensioned Floor plan
- Dimensioned Top view
- Unit control schematics and wiring diagrams
- Nameplate schedule
- Cable entry/exit locations
- Assembly ratings, including short circuit, voltage, and continuous current ratings
- Major component ratings
- Minimum clearances to other equipment.
- Frequency spectrum for harmonic currents at line side of filter (where provided) at 50% and 100% of rated load.
- Manufacturers technical data sheets

.6 The following information shall be submitted to Contract Administrator for record purposes:

- Final as-built drawings and information
- Certified production test reports
- Installation information
- Seismic certification and equipment anchorage details (where applicable)
- Operation and maintenance manuals. Manuals shall include as a minimum: Instruction books and/or leaflets, recommended renewal parts list and a complete set of as-built drawings

PART 2 PRODUCTS

2.1 Not Used

PART 3 EXECUTION

3.1 Installation

.1 Install in accordance with Manufacturer's installation instructions.

.2 Hire factory trained representative for set up and commissioning of RVS. Provide written report to Contract Administrator.

.3 Set up so that Pump ramps up to speed over 30 seconds and ramps down over 30 seconds.

.4 Confirm power lugs on starter can accommodate the pump motor cable leads.

.5 Hire factory trained representative to provide one day of training for City of Winnipeg personnel.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 American National Standards Institute (ANSI)

.1 Most recent ANSI C82.1- 1995, Specifications For Fluorescent Lamp Ballasts.

.2 Most recent ANSI C82.4- 19 92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaries where specified, for approval by Consultant.

.3 Photometric data to include: VCP Table spacing criterion, polarplot candela distribution, IES photometric file on computer disk.

PART 2 PRODUCTS

2.1 Lamps

.1 Fluorescent lamps.

Wattage	Bulb	Base	Type	Initial Lumens	Life h	Notes	Colour
-	T8-32	md.bip	RS	3150	24000	Cool	4000 White

2.2 Ballasts

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, discrete electronic IC electronic IC.

.1 Rating: 120V, 60 Hz, for use with, rapid start lamps.

.2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.

.3 Totally encased and designed for 40 C ambient temperature.

.4 Power factor: minimum 95 % with 95% of rated lamp lumens.

.5 Crest factor: 1.5 maximum current, 2.0 maximum voltage.

.6 Capacitor: thermally protected.

.7 Thermal protection: non-resettable on coil.

.8 Harmonics: 10 % maximum THD, including 49th for electronic discrete and hybrid ballasts, 25 % maximum THD including 49th for electromagnetic ballasts.

.9 Operating frequency of electronic ballast: 21 khz minimum.

.10 Total Circuit Power: 62 Watts.

.11 Ballast Factor: greater than 0.90.

.12 Sound rated: Class A.

.13 Mounting: integral with luminaire.

.14 Where available use premium electronic ballasts compliant with the Manitoba Hydro power smart program. Submit breakdown with tender documents.

2.3 Finishes

.1 Baked enamel finish:

.1 Conditioning of metal before painting:

.1 For corrosion resistance conversion coating to ASTM F 1137.

.2 For paint base, conversion coating to ASTM F 1137.

.2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel polyester powdercoat alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.

.3 Reflector and other inside surfaces finished as follows:

.1 White, minimum reflection factor 85%.

.2 Colour fastness: yellowness factor not above 0.02 and after 250 h exposure in Atlas fade-ometer not to exceed 0.05.

.3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.

.4 Gloss not less than 80 units as measured with Gardner 60 gloss meter.

.5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.

.6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

PART 3 EXECUTION

3.1 Installation

.1 Locate and install luminaries as indicated.

3.2 Luminaire Supports

.1 For suspended ceiling installations support luminaries from ceiling in accordance with local inspection requirements.

3.3 Luminaire Alignment

.1 Align luminaries mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaries mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

PART 1 GENERAL

1.1 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with the specifications

1.2 Field Instrument Installation

.1 The Contractor shall install each item in accordance with manufacturer's instructions and other applicable drawings. The term "installation" includes specifically the physical mounting of remote devices as well as all electrical/instrument cable/connections. The Contractor shall identify and provide all necessary mounting hardware not purchased with the instrument.

.2 Flow meters and pressure transmitters shall be handed over to the mechanical division for installation. Co-ordinate activities with mechanical.

1.3 Field Instruments

.1 Receive, calibrate, tag, and store all instruments.

.2 Install all necessary conduit and wiring from the field instruments or field control panel.

.3 Make all wiring terminations at the field instruments, field control panel, and the field junction box. Label all cables and wires.

.4 Isolate all applicable instruments for line testing and return to service after testing.

.5 Inspect all wiring, terminations and labelling.

.6 Unload control panel sections and racks which may be shipped at different times from different shippers.

.7 Move control panel sections and racks to their specified installation locations and permanently set in place. Unloading and moving may be done as one operation depending upon construction status.

PART 2 PRODUCTS

2.1 Level Transmitters

.1 Device LT-1

.1 Acceptable Product: Miltronics MultiRanger 200

.2 Transducer to be complete with a submergence shield

PART 3 EXECUTION

3.1 Installation

.1 Instrument systems components not specifically located on drawings, but located on the drawings shall be field located as defined by mechanical piping and in accordance with the following:

.1 Instrument components shall not be attached to vibrating equipment, but shall be

remotely mounted to a solid structure or on approved instrument mounting stands.

.2 Location of instruments, when shown on the drawings, is only approximate. The Contractor is responsible for actual location of field devices and must avoid interferences between conduit, pipes, equipment and instruments while providing maximum accessibility.

.3 Locate instrument components at eye level and in an easily accessible location.

.4 Instrument components that must be removed for servicing shall be installed with re-usable connectors, unions and flexible conduit.

.5 Electrical connections and terminations for field instruments and other field devices shall be in strict compliance with the manufacturer's instructions and loop drawings. This will include wire, wire termination, labeling, rigid and flexible conduit, fittings, and seals where required.

.2 Provide and route all instrument signal armoured cable (or conduit and conductors).

.3 For instruments with pre-terminated cable lengths provide a junction box as close as practical to connect with armoured cable or cable in conduit.

.4 Allow for a variation of 3 meters from locations of devices as shown on drawings without extra cost provided pertinent information is provided prior to installation. Exact location will be determined by the installation of piping and mechanical equipment.

.5 Threaded fastenings for mounting instrument components shall have either lock nuts or double nuts.

.6 Install wall and pipe stand mounted transmitters on approved mounting brackets or stands at a nominal height of 1.4 meters off floor.

.7 Cover locally mounted instrument components, after installation, with plastic bags to protect them from dust, dirt, paint spray, insulation materials, etc. Protect from mechanical damage.

.8 Set output pressure of local air sets to pressure recommended for instrument to which it is to be connected.

.9 Independently support solenoids, regulators or similar control devices on solid, vibration-free structures and not on control valves. Minimize load on pneumatic tubing.

.10 Field instruments located out doors shall be winterized to prevent process or measurement fluids from freezing. The use of steam or electrical tracing, fill fluids, or enclosures will be shown on the Installation Detail drawings.

.11 All instrument signal wiring and 120 V ac wiring shall be run by the Contractor from the field instrument to the field device as shown on the Loop drawings. This includes wiring, rigid and flexible conduit, fittings and seals where shown. Conduit penetrations are not permitted into the top of any field junction box.

3.2 Instrument Installation

.1 Level transmitters

.1 Provide, install and terminate power and control cables at remote electronics.

Install, route and terminate primary-converter cable as per manufacturers instructions and guidelines.

3.3 Instrument Supports

.1 Clean and paint fabricated galvanized carbon steel mounting stands and brackets.

.2 Before a mounting stand is attached to a concrete floor the surface of the concrete to be in contact with grout shall be roughed and cleaned of all dirt, oil, grease and loose material.

3.4 Calibration Tagging

.1 When satisfactorily inspected and calibrated, the item shall have a tag affixed to it in an immediately visible location, which shall indicate that the device has been calibrated, by whom and the date of the calibration. Calibration procedures and records shall be available to the Contract Administrator throughout the course of the project and shall be delivered to the Contract Administrator upon the completion of the work.

3.5 Permanent Instrument Identification Tagging

.1 All field-mounted instrument items shall have an approved identification tag permanently attached by the Contractor upon completion of the initial inspection and calibration. This tag shall reflect the device's identification as shown on the appropriate drawing.

.2 The tag will be permanently attached to the instrument with screws, rivets, or stainless steel or Monel wire, as appropriate. If an instrument is inside a protective enclosure or mounted behind a panel, instrument identity tags shall be mounted twice, once on the instrument and again on the enclosure. All instruments mounted on a control panel shall have an identity tag mounted on the instrument body and again on the face of the panel below the instrument face.

3.6 Wire, Cable and Terminal Tagging

.1 Each wire in alternating current applications and each wire in direct current applications shall be identified at each termination by a permanent label displaying the wire numbers. Each multiconductor cable shall be identified at each end with a permanent label displaying its cable number.

3.7 Documentation Responsibilities

.1 The Contractor shall maintain a current, complete set of prints for all instrument and electrical drawings, wire list, and specifications with markups reflecting all approved changes and actual as-installed status of equipment. These shall be kept in a neat and legible manner to facilitate direct transfer to The City of Winnipeg. One complete set of these marked-up drawings, wire lists, and specifications shall be provided to The City of Winnipeg after construction has been completed and before plant startup.

END OF SECTION

E2 - CONSTRUCTION DRAWINGS

E3 – REFERENCE DRAWINGS