

INVITATION TO TENDER

RETURN BIDS TO:

Bid Receiving / Agriculture and Agri-Food Canada

Central Experimental Farm
 KW Neatby Building, Main Entrance
 960 Carling Ave
 Ottawa, ON
 K1A 0C6

TENDER TO:

Agriculture and Agri-Food Canada

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the construction listed herein and on any attached sheets at the price(s) set out therefor.

Comments

Title Replacement of Irrigation Pumps CEF Building 84		
Solicitation No. 16-1307		Date 2016-11-30
Client Reference No.		
File No. 16-1307		
Solicitation Closes: Tuesday, December 20, 2016, at 02:00 PM, EST.		
F.O.B <input type="radio"/> Plant <input type="radio"/> Destination <input type="radio"/> Other		
Address Enquiries to: Mike Pignat		
Title: Procurement/Contracts Officer		
Email: mike.pignat@canada.ca		
Telephone Number	Ext.	Fax Number
613 759-6157		
Destination Central Experimental Farm KW Neatby Building 960 Carling Ave Ottawa, ON		

Instructions: See Herein

Delivery Required	Delivery Offered	
Vendor / Firm Name and Address		
Telephone Number	Ext.	Fax Number
Name and title of person authorized to sign on behalf of Vendor / Firm (type or print)		
Signature		Date

SPECIAL INSTRUCTIONS TO BIDDERS

- SI01 Bid Documents
- SI02 Enquiries during the Solicitation Period
- SI03 Mandatory Site Visit
- SI04 Revision of Bid
- SI05 Bid Results
- SI06 Bid Validity Period
- SI07 Construction Documents
- SI08 Personnel Security Requirements
- SI09 Integrity Provisions - Declaration of Convicted Offences

SI01 BID DOCUMENTS

1) The following are the bid documents:

- (a) SPECIAL INSTRUCTIONS TO BIDDERS;
- (b) INSTRUCTIONS TO BIDDERS - Form A5319-E; and,
- (c) BID AND ACCEPTANCE FORM - Form A5312-E and any attachments thereto.

Canada reserves the right to revise or amend the Bid Documents prior to the date set for opening bids. Such revisions or amendments, if any, will be announced by an addendum or addenda to the documents.

Submission of a bid constitutes acknowledgement that the Bidder has read and agrees to be bound by these documents.

SI02 ENQUIRIES DURING THE SOLICITATION PERIOD

1) Enquiries regarding this bid must be submitted in writing to the Contracting Officer. The Contracting Officer for the purpose of this bid is:

Mike Pignat
Procurement/Contracts Officer
mike.pignat@canada.ca

- 2) Except for the approval of alternative materials as described in IB14 of the INSTRUCTIONS TO BIDDERS, enquiries should be received no later than five (5) calendar days prior to the date set for solicitation closing to allow sufficient time to provide a response. Enquiries received after that time may not result in an answer being provided.
- 3) To ensure consistency and quality of the information provided to Bidders, the Contracting Officer shall examine the content of the enquiry and shall decide whether or not to issue an amendment.
- 4) All enquiries and other communications related to this bid sent throughout the solicitation period are to be directed ONLY to the Contracting Officer. Non-compliance with this requirement during the solicitation period can, for that reason alone, result in disqualification of a bid.

SI03 MANDATORY SITE VISIT

- 1) Before submitting their bid, the Contractor shall examine the jobsite, construction and storage areas, compare drawings and specifications with existing conditions, and fully satisfy themselves as to all data and matters required for the completion of the contract.
- 2) There will be a site visit on Wednesday, December, 7, 2016 at 10:00 AM PM EST.

Interested bidders are to meet at:

KW Neatby Building - Main Lobby
960 Carling Ave. Ottawa, ON K1A 0C6

The site visit for this project is MANDATORY. The representative of the bidder will be required to sign the Site Visit Attendance Sheet at the site visit. Bids submitted by Bidders who have not signed the attendance sheet will not be accepted.

SI04 REVISION OF BID

- 1) A bid may be revised by letter or facsimile in accordance with IB10 of the INSTRUCTIONS TO BIDDERS. The facsimile number for receipt of revisions is: 613 759-7005.

SI05 BID RESULTS

- 1) Following bid closing, bid results may be obtained from the bid receiving office by email at mike.pignat@canada.ca.

SI06 BID VALIDITY PERIOD

- 1) Canada reserves the right to seek an extension to the bid validity period prescribed in Clause 4 of the BID AND ACCEPTANCE FORM. Upon notification in writing from Canada, Bidders shall have the option to either accept or reject the proposed extension.

SI07 CONSTRUCTION DOCUMENTS

- 1) The successful contractor will be provided with one paper copy of the sealed and signed drawings, the specifications and the amendments upon acceptance of the offer. Additional copies, up to a maximum of one (1), will be provided free of charge upon request by the Contractor. Obtaining more copies shall be the responsibility of the Contractor including costs.

SI08 PERSONNEL SECURITY REQUIREMENTS

- 1) The successful Bidder's personnel, as well as any subcontractor and its personnel, who are required to perform any part of the work pursuant to the subsequent contract, must meet the following contract security requirements:
 - Personnel who are required to perform any part of the work must EACH hold a valid personnel security screening at the level of RELIABILITY STATUS, granted or approved by Agriculture and Agri-Food Canada. Until the security screening of the personnel has been completed satisfactorily by Agriculture and Agri-Food Canada, the Contractor/Subcontractor personnel MAY NOT perform contract work. Each of the proposed staff must complete "Security Clearance Form" (TBS 330-23E) upon request from Canada.

SI09 INTEGRITY PROVISIONS – DECLARATION OF CONVICTED OFFENCES

As applicable, pursuant to IB18 of the Declaration of Convicted Offences, paragraph 10 (copied below) of the General Instruction AAFC / AAC5319, the Bidder must provide with its bid, a completed [Declaration Form](#), to be given further consideration in the procurement process.

Declaration of Convicted Offences

Where a Bidder or its Affiliate is unable to certify that it has not been convicted of any of the offences referenced under the Canadian Offences Resulting in Legal Incapacity, the Canadian Offences and the Foreign Offences subsections, the Bidder must provide with its bid the completed [Declaration Form](#), to be given further consideration in the procurement process.



INSTRUCTIONS TO BIDDERS

- IB01 Completion of Bid
- IB02 Identity or Legal Capacity of the Bidder
- IB03 Applicable Taxes
- IB04 Tax to Be Included
- IB05 Capital Development and Redevelopment Charges
- IB06 Registry and Pre-qualification of Floating Plant
- IB07 Listing of Subcontractors and Suppliers
- IB08 Bid Security Requirements
- IB09 Submission of Bid
- IB10 Revision of Bid
- IB11 Acceptance of Bid
- IB12 Bid Costs
- IB13 Compliance with Applicable Laws
- IB14 Approval of Alternative Materials
- IB15 Income Tax Requirement
- IB16 Contingency Fees
- IB17 Status of the Bidder
- IB18 Integrity Provisions - Bids Over \$10,000.00
- IB19 Code of Conduct for Procurement - Bid

IB01 Completion of Bid

- 1) The bid shall be:
 - (a) submitted on the BID AND ACCEPTANCE FORM provided by AAFC or on a clear and legible reproduced copy of such BID AND ACCEPTANCE FORM that must be identical in content and format to the BID AND ACCEPTANCE FORM provided by AAFC;
 - (b) based on the Bid Documents listed in the SPECIAL INSTRUCTIONS TO BIDDERS;
 - (c) correctly completed in all respects;
 - (d) signed, with an original signature, by a duly authorized representative of the Bidder; and
 - (e) accompanied by any other document or documents specified elsewhere in the solicitation where it is stipulated that said documents are to accompany the bid.
- 2) Subject to paragraph 6) of IB11, any alteration to the pre-printed or pre-typed sections of the BID AND ACCEPTANCE FORM, or any condition or qualification placed upon the bid shall be cause for disqualification. Alterations, corrections, changes or erasures made to statements or figures entered on the BID AND ACCEPTANCE FORM by the Bidder shall be initialed by the person or persons signing the bid. Initials shall be original(s). Alterations, corrections, changes or erasures that are not initialed shall be deemed void and without effect.
- 3) Unless otherwise noted elsewhere in the Bid Documents, facsimile copies of bids are not acceptable.

IB02 Identity or Legal Capacity of the Bidder

- 1) In order to confirm the authority of the person or persons signing the bid or to establish the legal capacity under which the Bidder proposes to enter into Contract, any Bidder who carries on business in other than its own personal name shall, if requested by Canada, provide satisfactory proof of:
 - (a) such signing authority; and
 - (b) the legal capacity under which it carries on business;prior to contract award. Proof of signing authority may be in the form of a certified copy of a resolution naming the signatory(ies) that is (are) authorized to sign this bid on behalf of the corporation or partnership. Proof of legal capacity may be in the form of a copy of the articles of incorporation or the registration of the business name of a sole proprietor or partnership.

IB03 Applicable Taxes

- 1) Bidders are not to include any amounts for Applicable Taxes (Goods and Services Tax (GST), Harmonized Sales Tax (HST) or Quebec Sales Tax (QST), whichever is applicable. Any amount levied in respect of Applicable Taxes shall be billed as a separate item in a progress claim submitted by the Contractor, and shall be paid to the Contractor in addition to the amount approved by Canada for work performed under the Contract. The Contractor shall be required to remit the appropriate amount to the appropriate tax authority in accordance with the applicable legislation.

IB04 Tax to Be Included

- 1) The Contractor is not entitled to use Canada's exemptions from any tax, such as provincial sales taxes, unless otherwise specified by law. The Contractor must pay applicable provincial sales tax, ancillary taxes, and any commodity tax, on taxable goods or services used or consumed in the performance of the Contract (in accordance with applicable legislation), including for material incorporated into real property.

IB05 Capital Development and Redevelopment Charges

- 1) For the purposes of GC1.5 in the General Conditions of the Contract, only fees or charges directly related to the processing and issuing of building permits shall be included. The Bidder shall not include any monies in the bid amount for special municipal development, redevelopment or other fees or charges which a municipal authority may seek as a prerequisite to the issuance of building permits.

IB06 Registry and Pre-qualification of Floating Plant

- 1) Dredges or other floating plant to be used in the performance of the Work must be of Canadian registry. For dredges or other floating plant that are not of Canadian make or manufacture, the Bidder must obtain a certificate of qualification from Industry Canada and this certificate must accompany the bid. Plant so qualified by Industry Canada may be accepted on this project.

IB07 Listing of Subcontractors and Suppliers

- 1) Notwithstanding any list of Subcontractors that the Bidder may be required to submit as part of the bid, the Bidder submitting the lowest acceptable bid shall, within 48 hours of receipt of a notice to do so, submit all information requested in the said notice including the names of Subcontractors and Suppliers for the part or parts of the Work listed. Failure to do so may result in the disqualification of its bid.

IB08 Bid Security Requirements

- 1) **NO** bid security is required for this solicitation notice.

IB09 Submission of Bid

- 1) The BID AND ACCEPTANCE FORM, duly completed, shall be enclosed and sealed in an envelope provided by the Bidder, and shall be addressed and submitted to the office designated on the Front Page of the BID AND ACCEPTANCE FORM for the receipt of bids. The bid must be received on or before the date and time set for solicitation closing.
- 2) Unless otherwise specified in the SPECIAL INSTRUCTIONS TO BIDDERS
 - (a) the bid shall be in Canadian currency;
 - (b) exchange rate fluctuation protection is not offered; and
 - (c) any request for exchange rate fluctuation protection shall not be considered.
- 3) Prior to submitting the bid, the Bidder shall ensure that the following information is clearly printed or typed on the face of the bid envelope:
 - (a) Solicitation/File Number;
 - (b) Name of Bidder;
 - (c) Return address; and
 - (d) Closing Date and Time.
- 4) Subject to paragraph 6) of IB11, failure to comply with paragraphs 1), 2) and 3) of IB09 shall render the bid liable to disqualification. Timely and correct delivery of bids is the sole responsibility of the Bidder.

IB10 Revision of Bid

- 1) A bid submitted in accordance with these instructions may be revised by letter or facsimile provided the revision is received at the office designated for the receipt of bids, on or before the date and time set for the closing of the bid. The letter or facsimile shall:
 - (a) be on the Bidder's letterhead or bear a signature that identifies the Bidder;
 - (b) for the lump sum portion of a bid, clearly identify the amount of the current revision. The total aggregate sum of all revisions submitted, including the current revision, shall be shown separately; and
 - (c) for the Price Per Unit portion of a bid, clearly identify the change(s) in the Price(s) per Unit and the specific Item (s) to which each change applies. If a revision is to be applied to a specific Item that was previously amended then, in addition to the amount of the current revision, the total aggregate sum of all revisions submitted, including the current revision, for that Item shall be shown separately.
- 2) A letter or facsimile submitted to confirm an earlier revision shall be clearly identified as "CONFIRMATION ONLY" for each contemplated change.
- 3) Failure to comply with any of the above provisions shall result in the rejection of the non-compliant revision(s) only. The bid shall be evaluated based on the original bid submitted and all other compliant revision(s).

IB11 Acceptance of Bid

- 1) Canada may accept any bid, whether it is the lowest or not, or may reject any or all bids.
- 2) Without limiting the generality of paragraph 1) of IB11, Canada may reject a bid if any of the following circumstances is present:
 - (a) the Bidder, or any employee or subcontractor included as part of the bid, has been convicted under section 121 ("Frauds on the government" & "Contractor subscribing to election fund"), 124 ("Selling or purchasing office"), 380 ("Fraud committed against Her Majesty") or 418 ("Selling defective stores to Her Majesty") of the Criminal Code of Canada; or under paragraph 80(1)(d) ("False entry, certificate of return"), subsection 80(2) ("Fraud against Her Majesty") or Section 154.01 ("Fraud against Her Majesty") of the *Financial Administration Act*;
 - (b) the Bidder's bidding privileges are suspended or are in the process of being suspended;
 - (c) the bidding privileges of any employee or subcontractor included as part of the bid are suspended or are in the process of being suspended, which suspension or pending suspension would render that employee or subcontractor ineligible to bid on the Work, or the portion of the Work the employee or subcontractor is to perform;
 - (d) with respect to current or prior transactions with Canada
 - (i) the Bidder is bankrupt or if, for whatever reason, its activities are rendered inoperable for an extended period;
 - (ii) evidence, satisfactory to Canada, of fraud, bribery, fraudulent misrepresentation or failure to comply with any law protecting individuals against any manner of discrimination, has been received with respect to the Bidder, any of its employees or any subcontractor included as part of its bid;
 - (iii) Canada has exercised, or intends to exercise, the contractual remedy of taking the work out of the contractor's hands with respect to a contract with the Bidder, any of its employees or any subcontractor included as part of its bid; or
 - (iv) Canada determines that the Bidder's performance on other contracts is sufficiently poor to jeopardize the successful completion of the requirement being bid on.
- 3) In assessing the Bidder's performance on other contracts pursuant to subparagraph 2)(d)(iv) of IB11, Canada may consider, but not be limited to, such matters as:
 - (a) the quality of workmanship in performing the Work;
 - (b) the timeliness of completion of the Work;
 - (c) the overall management of the Work and its effect on the level of effort demanded of the department and its representative; and
 - (d) the completeness and effectiveness of the Contractor's safety program during the performance of the Work.
- 4) Without limiting the generality of paragraphs 1), 2) and 3) of IB11, Canada may reject any bid based on an unfavourable assessment of the:
 - (a) adequacy of the bid price to permit the work to be carried out and, in the case of a bid providing prices per unit or a combination of lump sum and prices per unit, whether each such price reasonably reflects the cost of

- performing the part of the work to which that price applies;
 - (b) Bidder's ability to provide the necessary management structure, skilled personnel, experience and equipment to perform competently the work under the Contract; and
 - (c) Bidder's performance on other contracts.
- 5) If Canada intends to reject a bid pursuant to a provision of paragraphs 1), 2), 3) or 4) of IB11, other than subparagraph 2)(b) of IB11, Canada shall so inform the Bidder and provide the Bidder ten (10) days within which to make representations, prior to making a final decision on the bid rejection.
- 6) Canada may waive informalities and minor irregularities in bids received if Canada determines that the variation of the bid from the exact requirements set out in the Bid Documents can be corrected or waived without being prejudicial to other Bidders.

IB12 Bid Costs

- 1) No payment will be made for costs incurred in the preparation and submission of a bid in response to the bid solicitation. Costs associated with preparing and submitting a bid, as well as any costs incurred by the Bidder associated with the evaluation of the bid, are the sole responsibility of the Bidder.

IB13 Compliance with Applicable Laws

- 1) By submission of a bid, the Bidder certifies that the Bidder has the legal capacity to enter into a contract and is in possession of all valid licences, permits, registrations, certificates, declarations, filings, or other authorizations necessary to comply with all federal, provincial and municipal laws and regulations applicable to the submission of the bid and entry into any ensuing contract for the performance of the work.
- 2) For the purpose of validating the certification in paragraph 1) of IB13, a Bidder shall, if requested, provide a copy of every valid licence, permit, registration, certificate, declaration, filing or other authorization listed in the request, and shall provide such documentation within the time limit(s) set out in the said request.
- 3) Failure to comply with the requirements of paragraph 2) of IB13 shall result in disqualification of the bid.

IB14 Approval of Alternative Materials

- 1) When materials are specified by trade names or trademarks, or by manufacturers' or suppliers' names, the bid shall be based on use of the named materials. During the bid period, alternative materials may be considered provided full technical data is received in writing by the Contracting Officer at least 10 calendar days prior to the bid closing date.

IB15 Income Tax Requirement

- 1) Payments made under applicable contracts must be reported by Canada for taxation purposes. To comply with this requirement, the successful bidder shall provide to Canada immediately upon award: its legal name; address; and Revenue Canada identifier (SIN, BN, GST/HST, T2N number) as is applicable.

IB16 Contingency Fees

- 1) The Bidder declares that the Bidder has not, directly or indirectly, paid or agreed to pay, and will not, directly or indirectly, pay a contingency fee to any individual for the solicitation, negotiation or obtaining of the contract if the payment of the fee would require the individual to file a return under section 5 of the *Lobbying Act*.

IB17 Status of the Bidder

- 1) The Bidder declares that the Bidder has not been convicted of an offence, other than an offence for which a pardon has been granted, under section 121, 124 or 418 of the *Criminal Code*.

IB18 Integrity Provisions - Bids Over \$10,000.00

- 1) Ineligibility and Suspension Policy (the "Policy"), and all related Directives, are incorporated by reference into, and form

a binding part of the procurement process. The Supplier must comply with the Policy and Directives, which can be found at *Ineligibility and Suspension Policy*.

- 2) Under the Policy, charges and convictions of certain offences against a Supplier, its affiliates or first tier subcontractors, and other circumstances, will or may result in a determination by Public Works and Government Services Canada (PWGSC) that the Supplier is ineligible to enter, or is suspended from entering into a contract with Canada. The list of ineligible and suspended Suppliers is contained in PWGSC's Integrity Database. The Policy describes how enquiries can be made regarding the ineligibility or suspension of Suppliers.
- 3) In addition to all other information required in the procurement process, the Supplier must provide the following:
 - a. by the time stated in the Policy, all information required by the Policy described under the heading "Information to be Provided when Bidding, Contracting or Entering into a Real Property Agreement"; and
 - b. with its bid / quote / proposal, a complete list of all foreign criminal charges and convictions pertaining to itself, its affiliates and its proposed first tier subcontractors that, to the best of its knowledge and belief, may be similar to one of the listed offences in the Policy. The list of foreign criminal charges and convictions must be submitted using an Integrity Declaration Form, which can be found at [Declaration form for procurement](#).
- 4) Subject to subsection 5, by submitting a bid / quote / proposal in response a request by AAFC, the Supplier certifies that:
 - a. it has read and understands the *Ineligibility and Suspension Policy*;
 - b. it understands that certain domestic and foreign criminal charges and convictions, and other circumstances, as described in the Policy, will or may result in a determination of ineligibility or suspension under the Policy;
 - c. it is aware that Canada may request additional information, certifications, and validations from the Supplier or a third party for purposes of making a determination of ineligibility or suspension;
 - d. it has provided with its bid / quote / proposal a complete list of all foreign criminal charges and convictions pertaining to itself, its affiliates and its proposed first tier subcontractors that, to the best of its knowledge and belief, may be similar to one of the listed offences in the Policy;
 - e. none of the domestic criminal offences, and other circumstances, described in the Policy that will or may result in a determination of ineligibility or suspension, apply to it, its affiliates and its proposed first tier subcontractors; and
 - f. it is not aware of a determination of ineligibility or suspension issued by PWGSC that applies to it.
- 5) Where a Supplier is unable to provide any of the certifications required by subsection 4, it must submit with its bid/ quote / proposal a completed Integrity Declaration Form, which can be found at [Declaration form for procurement](#).
- 6) Canada will declare non-responsive any bid / quote / proposal in respect of which the information requested is incomplete or inaccurate, or in respect of which the information contained in a certification or declaration is found by Canada to be false or misleading in any respect. If Canada establishes after award of the Contract that the Supplier provided a false or misleading certification or declaration, Canada may terminate the Contract for default. Pursuant to the Policy, Canada may also determine the Supplier to be ineligible for award of a contract for providing a false or misleading certification or declaration.

Ineligibility and Suspension Policy - <http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html>

Declaration form for procurement - <http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html>

IB19 Code of Conduct for Procurement - Bid

- 1) The Code of Conduct for Procurement provides that Bidders must respond to bid solicitations in an honest, fair and comprehensive manner, accurately reflect their capacity to satisfy the requirements set out in the bid solicitation and resulting contract, submit bids and enter into contracts only if they will fulfill all obligations of the Contract. By submitting a bid, the Bidder is certifying that it is complying with the Code of Conduct for Procurement. Failure to comply with the Code of Conduct for Procurement may render the bid non-responsive.



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GENERAL CONDITIONS FOR MINOR WORKS

GC 1 GENERAL PROVISIONS

GC 1.1 Definition

- "Applicable Taxes" means the Goods and Services Tax (GST), the Harmonized Sales Tax (HST), and any provincial tax, by law, payable by Canada such as, the Quebec Sales Tax (QST) as of April 1, 2013.
- "Canada", "Her Majesty" means Her Majesty, the Queen in right of Canada;
- "Contract" means the contract documents referred to as such therein and every other document specified or referred to in any of them as forming part of the Contract, all as amended by agreement of the parties;
- "Contractor" means a person, with whom Canada enters into a Contract to do the Work;
 - "Departmental Representative" means the person designated in the Contract, or by written notice to the Contractor, to act as the Departmental Representative for the purposes of the Contract, and includes a person, designated and authorized in writing by the Departmental Representative to the Contractor;
- "Material" includes all commodities, articles, machinery, equipment, fixtures and things required to be furnished in accordance with the Contract for incorporation into the Work;
- "Person" includes, unless there is an express stipulation in the Contract to the contrary, any partnership, proprietorship, firm, joint venture, consortium or corporation;
- "Plant" includes all tools, implements, machinery, vehicles, structures, equipment, articles and things that are necessary for the performance of the Contract, other than Material and those tools customarily provided by a trades person in practicing a trade;
- "Work" means everything that is necessary to be done, furnished or delivered by the Contractor to perform the Contract in accordance with the Contract Documents;

GC 1.2 Contract Documents

1. In interpreting the Contract, in the event of discrepancies or conflicts between anything in the Drawings and Specifications or Scope of Work and the General Conditions, the General Conditions govern.
2. In interpreting the Drawings and Specifications, in the event of discrepancies or conflicts between:
 - (a) the Drawings and Specifications, the Specifications govern;
 - (b) the Drawings, the Drawings with the largest scale govern; and
 - (c) figured dimensions and scaled dimensions, the figured dimensions govern.

GC 1.3 Assignment

1. This Contract shall not be assigned without the written consent of Canada.

GC 1.4 Subcontracting

1. The Contractor shall:
 - (a) not subcontract the whole or any part of the Work without the written consent of the Departmental Representative except for subcontracts specified in the Contract; and
 - (b) ensure that all subcontracts entered into at any tier shall incorporate all the terms and conditions of the Contract that can reasonably be applied thereto.

GC 1.5 Laws, Permits and Taxes

1. The Contractor shall comply with all legislative and regulatory provisions whether federal, provincial, territorial or municipal applicable to the performance of the Work and shall require compliance therewith by all of its subcontractors and suppliers at any tier as if the Work were being performed for an owner other than Canada.
2. Unless otherwise provided for in the Contract, the Contractor shall obtain all permits and hold all certificates and licenses required for the performance of the Work.
3. Applicable Taxes will be paid by Canada at time when a progress payment is being made. It is the sole responsibility of

the Contractor to charge Applicable Taxes at the correct rate in accordance with applicable legislation. The Contractor agrees to remit to appropriate tax authorities any amounts of Applicable Taxes paid or due.

4. The Contractor is not entitled to use Canada's exemptions from any tax, such as provincial sales taxes, unless otherwise specified by law. The Contractor must pay applicable provincial sales tax, ancillary taxes, and any commodity tax, on taxable goods or services used or consumed in the performance of the Contract (in accordance with applicable legislation), including for material incorporated into real property.

GC 1.6 Former Public Office Holders

1. No former public office holder who is not in compliance with the post-employment provisions of the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from the Contract.

GC 1.7 Status of the Contractor

1. The Contractor is engaged as an independent Contractor for the sole purpose of performing the Work. Neither the Contractor nor any of its personnel is engaged as an employee, servant or agent of Canada. The Contractor is responsible for all deductions and remittances required by law in relation to its employees including those required for Canada or Quebec Pension Plans, employment insurance, workers' compensation, and income tax.
2. The Contractor declares that the Contractor has not been convicted of an offence, other than an offence for which a pardon has been granted, under section 121, 124 or 418 of the Criminal Code.

GC 1.8 Contingency Fees

1. The Contractor declares that the Contractor has not, directly or indirectly, paid or agreed to pay, and will not, directly or indirectly, pay a contingency fee to any individual for the solicitation, negotiation or obtaining of the contract if the payment of the fee would require the individual to file a return under section 5 of the *Lobbying Act*.

GC 1.9 Disclosure of Basic Information

1. The Contractor consents, in the case of a contract that has a value in excess of \$10,000, to the public disclosure of basic information, other than information described in any of paragraphs 20(1)(a) to (d) of the Access to Information Act, relating to the contract.

GC 1.10 Integrity Provisions - Contracts over \$10,000.00

- 1) The Ineligibility and Suspension Policy (the "Policy") and all related Directives are incorporated into, and form a binding part of the Contract. The Contractor must comply with the provisions of the Policy and Directives, which can be found on Public Works and Government Services Canada's website at Ineligibility and Suspension Policy. (<http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html>).

GC 1.11 Code of Conduct for Procurement - Contracts Over \$10,000.00

- 1) The Contractor agrees to comply with the Code of Conduct (<http://www.tpsgc-pwgsc.gc.ca/app-acq/cndt-cndct/contexte-context-eng.html>) for Procurement and to be bound by its terms for the period of the Contract.

GC 2 ADMINISTRATION OF THE CONTRACT

GC 2.1 Departmental Representative's Rights and Obligations

1. The Departmental Representative shall:
 - (a) have access to the Work at all times;
 - (b) decide questions regarding what has been done or what the Contractor is required to do;
 - (c) decide questions regarding the acceptability of the quality or quantity of any Labour, Plant or Material used or consumed in the execution of the Work; and
 - (d) decide questions regarding the timing and scheduling of the Work.

GC 2.2 Contractor's Superintendent and Workers

1. The Contractor shall keep a competent superintendent and capable and skilled workers on the site of the Work at all times during the progress of the Work. If, in the opinion of the Departmental Representative, the superintendent or the workers are deemed to be unacceptable because of incompetence, improper conduct or security risk, they shall be removed from the site of the Work and replaced forthwith.

GC 2.3 Records to be Kept by the Contractor

1. The Contractor shall maintain and keep intact complete records relating to the Work together with all tender calls, quotations, contracts, correspondence, invoices and any payment of fees or other compensation for the solicitation, negotiating or obtaining of the contract until the expiration of two (2) years after the date that a Certificate of Completion is issued or the final invoice is paid if no Certificate of Completion is issued. The Contractor shall, upon request from the Departmental Representative, make said records available for copy, audit or inspection to any person(s) acting on behalf of Canada.
2. The Contractor shall cause all Subcontractors, and all other Persons or entities directly or indirectly involved with the Work, to comply with the requirements of GC 2.3.1.

GC 2.4 Notices

1. Any notice shall be in writing and may be delivered by hand, by courier, by registered or regular mail, or by facsimile or other electronic means that provides a paper record of the text of the notice. The notice shall be addressed to the party for whom it is intended at the address in the Contract or at the last address from which the sender has received notice in accordance with this section. Any notice shall be deemed to be effective on the day it is received at that address or four (4) days after being sent, whichever is the earlier.

GC 3 EXECUTION OF THE WORK

GC 3.1 Material, Plant, and Real Property Become the Property of Canada

1. All Material and Plant used or consumed for the purposes of the Work shall be the property of Canada. The Material and Plant shall be used only for the purposes of the Work, and shall not be removed from the site of the Work until so approved by the Departmental Representative.
2. The Contractor shall be liable for all loss or damage to Material or Plant that is the property of Canada by virtue of this section.

GC 3.2 Cooperation with Other Contractors

1. The Contractor shall cooperate fully with other contractors or workers sent onto the site of the Work by the Departmental Representative.
2. If, at the time the Contract was executed: the Contractor could not have reasonably foreseen the sending of other contractors or workers onto the site of the Work; and, the Contractor incurs extra costs in complying with GC 3.2.1; and, the Contractor gives written notice of claim for the extra costs within ten (10) days from the date upon which the other contractors or workers were sent onto the site of the Work; then, Canada shall pay an additional amount to the Contractor, calculated pursuant to GC 5.7.

GC 3.3 Use of the Work and Cleanup of Site

1. The Contractor shall maintain the site of the Work in a tidy condition and free from the accumulation of waste material throughout the duration of the Contract.
2. Before the Departmental Representative issues the Certificate of Completion or approves payment of the final invoice, the Contractor shall remove all materials, tools, construction machinery, equipment, waste products and debris from the

site of the Work.

3. Where the Work affects occupied portions of a building, the Contractor shall ensure continuity of all building services and shall ensure safe access for all persons requiring access to said building.

GC 3.4 Warranty and Rectification of Defects

1. Without restricting any warranty or guarantee implied or imposed by law or any extended warranty specified in the Contract, the Contractor shall, upon notice from the Departmental Representative and at its own expense, rectify all defects which appear in the Work within twelve (12) months from the date of issuance of the Certificate of Completion pursuant to GC 5.6.1, or from the date of the negotiable instrument issued as final payment if a Certificate of Completion is not issued, whichever is applicable.
2. The notice referred to in GC 3.4.1 shall be in writing and shall include the number of days within which the defect or fault is to be rectified.
3. The Contractor shall transfer and assign, to Canada, any subcontractor, manufacturer or supplier extended warranties or guarantees implied or imposed by law or contained in the contract documents covering periods beyond the twelve (12) months stipulated above. Extended warranties or guarantees referred to herein shall not extend the twelve (12) month period whereby the Contractor must rectify and make good any defect or fault that appears in the work or comes to the attention of Canada.

GC 4 PROTECTION, HEALTH AND SAFETY

GC 4.1 Material, Plant and Real Property Supplied by Canada

1. The Contractor, having care, custody and control of the Work and its site, shall be responsible for any loss or damage, excluding reasonable wear and tear, to any property of Canada arising out of the performance of the Work whether or not such loss arises from causes beyond the Contractor's control.

GC 4.2 Construction Safety

1. The Contractor shall be responsible for the health and safety of all persons granted access to the site of the Work and for initiating, maintaining and supervising all safety inspections, precautions and programs in connection with the performance of the Work in accordance with the health and safety legislation in force in the Province where the Work is being performed.

GC 5 TERMS OF PAYMENT

GC 5.1 Definitions

For the purposes of this section:

- Payment Period means a period of thirty (30) days or such other longer period as may be agreed between the Contractor and the Departmental Representative.
- An amount is Due and Payable when it is due and payable by Canada to the Contractor in accordance with the terms of the Contract.
- An amount is Overdue when it remains unpaid after the day upon which it is due and payable.
- Date of Payment means the date of the negotiable instrument of an amount due and payable by the Receiver General for Canada.
- Fixed Price Arrangement means that part of the Contract that prescribes a lump sum as payment for performance of the Work to which it relates.
- Unit Price Arrangement means that part of the Contract that prescribes the product of a Price Per Unit multiplied by a number of Units of Measurement of a Class as payment for performance of the Work to which it relates.
- Price Table means the table set out in the BID AND ACCEPTANCE FORM.
- Bank Rate means the rate of interest established from time to time by the Bank of Canada as the minimum rate at

which the Bank of Canada makes short term advances to members of the Canadian Payments Association.

- Average Bank Rate means the simple arithmetic mean of the Bank Rates in effect at 4:00 pm Eastern Time each day during the calendar month which immediately precedes the calendar month in which payment is made.
- Duration of the Work means the number of calendar days required to complete the Work, commencing on the first day following receipt by the Contractor of the fully executed Contract and ending the day on which the Departmental Representative verifies that the Work has been satisfactorily completed.

GC 5.2 Payment - General Provisions

1. It is a condition precedent to Canada's obligation under GC 5.3.5 that the Contractor has made and delivered to the Departmental Representative, a statutory declaration as described in GC 5.2.2.
2. A statutory declaration in a form acceptable to Canada shall contain a declaration that the Contractor has complied with all lawful obligations with respect to workers and that all lawful obligations towards Subcontractors and Suppliers in respect of the Work under the Contract have been fully discharged.
3. A payment by Canada pursuant to this section shall not be construed as evidence that the Work is satisfactory or in accordance with the Contract.
4. Delay in making payment by Canada under the Contract shall not constitute a breach of Contract.
5. Without limiting any right of setoff or deduction given or implied by law or elsewhere in the Contract, Canada may retain from amounts payable to the Contractor under the Contract, any amount payable to Canada by the Contractor under the Contract or any other current contract.
6. No additional payment shall be made for delays where the cause of the delay was under the control of the Contractor.
7. Except as provided for in these General Conditions, the amount payable to the Contractor under the Contract shall not be increased or decreased by reason of any increase or decrease in cost of the Work brought about by any increase in the cost of Labour, Plant or Material.
8. In the event of a change, including a new imposition or repeal of any tax, customs or other duty, charge, or any similar imposition that is imposed under sales or excise tax legislation of the Government of Canada or any Provincial or Territorial legislation, affects the cost of the Work to the Contractor, and occurs after the date of submission by the Contractor of the Contractor's bid, the contract amount shall be adjusted by an amount equal to the increased or decreased cost to the Contractor, which amount shall be determined through a detailed examination of the Contractor's records.
9. It is a term of every contract providing for the payment of any money by Her Majesty that payment under that contract is subject to there being an appropriation for the particular service for the fiscal year in which any commitment under that contract would come in course of payment. Section 40, *Financial Administration Act*, R.S., 1985, c. F-11, s. 40.

GC 5.3 Progress Payments

1. Where the duration of the Work is greater than thirty (30) days, the Contractor shall be entitled to receive monthly progress payments upon submitting a progress claim in a form approved by the Departmental Representative. Where the duration of the Work is less than thirty (30) days, the Contractor shall submit a progress claim after the Work is complete.
2. On the expiration of a Payment Period, the Contractor shall deliver to the Departmental Representative:
 - (a) a written progress claim that fully describes any part of the Work that has been satisfactorily completed and any Material that was delivered to the site of the Work but not incorporated into the Work during the Payment Period for which the progress claim relates;
 - (b) a completed and signed statutory declaration as described in GC 5.2.2; and
 - (c) in the case of the initial progress claim and the request for final payment, satisfactory evidence of compliance with workers compensation legislation that is applicable to the place of the Work.
3. Not later than ten (10) days after receipt of a progress claim properly submitted in accordance with GC 5.3.2, the Departmental Representative shall issue a progress report, a copy of which shall be given to the Contractor.
4. A progress report shall indicate the value of the part of the Work and Material described in the progress claim that, in

the opinion of Canada:

- (a) is in accordance with the Contract; and
- (b) was not included in any other progress report related to the Contract.

5. Not later than thirty (30) days after the receipt by the Departmental Representative of a properly submitted progress claim and supporting documentation, Canada shall make a progress payment to the Contractor in an amount that is equal to one of the following:
 - (a) 90 percent of the value that is indicated in the progress report; or
 - (b) If the Departmental Representative is satisfied that the Work is substantially complete and is acceptable for use by Canada, 100 percent of the value of the Work and Material that is in accordance with the Contract, less amounts previously paid for under the Contract, less the amount equal to the estimated cost of completing the Work and the estimated cost of rectifying defects and faults in the Work as determined by the Departmental Representative; or
 - (c) If the Departmental Representative is satisfied that the Work is complete, 100 percent of the value of the Work that is in accordance with the Contract less amounts previously paid for under the Contract;plus Applicable Taxes and less the aggregate of any amounts payable to or costs and damages claimed by Canada or by a Claimant against the Contractor.
6. The Departmental Representative reserves the right to increase or decrease the quantities submitted by the Contractor if there is a disagreement between the Contractor's invoiced quantities and the quantities shown in the records maintained at the site of the Work.
7. Subject to GC 5.3.8, GC 5.3.9 and GC 5.3.10, the Departmental Representative and the Contractor may, by an agreement in writing, amend a Price Per Unit as set out in the Price Table for any Class of Labour, Plant or Material provided the Certificate of Measurement shows that the Authorized Quantity of the Class of Labour, Plant or Material actually performed, used or supplied by the Contractor in performing the Work is:
 - (a) less than 85 percent of the Estimated Total Quantity; or
 - (b) in excess of 115 percent of the Estimated Total Quantity.
8. In no event shall the total amount of an Item set out in the Price Table that has been amended pursuant to GC 5.3.7 (a) exceed the amount that would have been Payable to the Contractor had the Estimated Total Quantity actually been performed, used, or supplied.
9. An amendment that is made necessary by GC 5.3.7 (b) shall apply only to the quantities that are in excess of 115 percent.
10. Where the Departmental Representative and the Contractor fail to agree on the amount of any adjustment to a Price Per Unit as contemplated by GC 5.3.7, the amended Price Per Unit shall be determined in accordance with GC 5.7.

GC 5.4 Interest on Overdue Accounts

1. Canada shall be liable to pay, to the Contractor, simple interest at the Average Bank Rate plus 3 percent per annum on any amount that is Overdue. The interest shall apply from the date such amount becomes Overdue until the day prior to the Date of Payment inclusively.
2. Interest shall be paid to the Contractor without demand on Overdue payments, except, in respect to amounts which are less than fifteen (15) days Overdue, in which case, no interest shall be paid unless the Contractor so demands.
3. Canada shall not be liable to pay interest where Canada is not responsible for the delay in paying the Contractor.

GC 5.5 Payment in the Event of Termination

1. If the Contract is terminated pursuant to GC 7.4, Canada shall pay the Contractor:
 - (a) an amount, as agreed upon by the Contractor and the Departmental Representative, for all Labour, Plant and Material performed, used or supplied by the Contractor as at the date of termination plus
 - (i) any fully supported termination costs incurred by the Contractor, less
 - (ii) any amounts payable to or costs and damages claimed by Canada or by a Claimant, against the

Contractor; or

- (b) failing such an agreement, an amount calculated in accordance with GC 5.7.2.

GC 5.6 Final Completion

1. A Certificate of Completion shall be issued to the Contractor on the date on which the Work has been completed and the Contractor has complied with the Contract and all orders and directions made pursuant thereto, all to the satisfaction of the Departmental Representative.
2. Where the Contract is, in whole or in part, a Unit Price Arrangement, the Departmental Representative shall, at the same time as the issuance of the Certificate of Completion, issue a Certificate of Measurement setting out the Authorized Quantities used or employed in respect of the classes and units set out in the Price Table under the BID AND ACCEPTANCE FORM and any subsequent amendments thereto, such certificate to be binding upon the Contractor and Canada.

GC 5.7 Determination of Price

1. By mutual agreement:
 - (a) where a Lump Sum Arrangement applies to the Contract or a part thereof, the price of any change shall be the aggregate estimated cost of Labour, Plant and Material that is required for the change as agreed upon in writing by the Contractor and Canada, and include an allowance for overhead, margin and the risk of undertaking the work within the stipulated amount;
 - (b) where a Unit Price Arrangement applies to the Contract or a part thereof, the Contractor and Canada may, by agreement in writing, add Items, Units of Measurement, Estimated Total Quantities and Price Per Units to the Price Table;
 - (c) a Price Per Unit referred to in GC 5.7.1 (b) shall be determined on the basis of the aggregate estimated cost of Labour, Plant and Material that is required for the additional Item as agreed upon by the Contractor and Canada, and include an allowance for overhead, margin and the risk of undertaking the work;
 - (d) to facilitate approval of the price of the additional Item, the Contractor shall submit a cost estimate breakdown identifying, as a minimum, the estimated cost of Labour, Plant, Material, each subcontract amount, and the amount of the appropriate percentage allowance;
 - (e) if no agreement can be reached as contemplated in GC5.7.1 (a), the price shall be determined in accordance with GC 5.7.2; and
 - (f) if no agreement can be reached as contemplated in GC 5.7.1 (b) and GC 5.7.1 (c), the Departmental Representative shall determine the Class and the Unit of Measurement of the Item of Labour, Plant or Material and the Price Per Unit shall be determined in accordance with GC 5.7.2.
2. Following Completion of the Additional Work
 - (a) Where it is not possible to predetermine, or where there is failure to agree upon the price of a change in the Work, the price of the change shall be equal to the aggregate of:
 - (i) all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the Labour, Plant and Material that fall within one of the classes of expenditure described in GC 5.7.2 (b), that are directly attributable to the performance of the Contract; plus
 - (ii) an allowance for profit and all other expenditures or costs equal to 10 percent of the sum of the amounts referred to in GC 5.7.2 (a)(i); plus
 - (iii) interest, if any, paid by the Contractor on the amounts determined under GC 5.7.2 (a)(i) and (ii), calculated in accordance with GC 5.4.
 - (b) The cost of Labour, Plant and Material referred to in GC 5.7.2 (a) shall be limited to the following categories of expenditure:
 - (i) payments to Subcontractors and suppliers;
 - (ii) wages, salaries and traveling expenses of employees of the Contractor located at the site of the Work and that portion of wages, salaries, bonuses, living and traveling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor provided they are actually and properly engaged on the Work under the Contract;
 - (iii) assessments payable under any statutory authority relating to workers' compensation, employment insurance, pension plan or holidays with pay, provincial health or insurance plans, environmental reviews, and GST/HST collection costs;
 - (iv) rent that is paid for Plant, or an amount equivalent to the said rent if the Plant is owned by the Contractor, that is necessary for and used in the performance of the Work, if the rent or the equivalent amount is reasonable and use of that Plant had been approved by the Departmental Representative;
 - (v) payments for maintaining and operating Plant necessary for and used in the performance of the Work,

- and payments for effecting repairs thereto that, in the opinion of the Departmental Representative, are necessary for the proper performance of the Contract, other than payments for any repairs to the Plant arising out of defects existing before its allocation to the Work;
- (vi) payments for Material that is necessary for and incorporated in the Work, or that is necessary for and consumed in the performance of the Contract;
 - (vii) payments for preparation, delivery, handling, erection, installation, inspection, protection and removal of the Plant and Material necessary for and used in the performance of the Contract; and
 - (viii) any other payments made by the Contractor with the approval of the Departmental Representative that are necessary for the performance of the Contract in accordance with the Contract Documents.

GC 5.8 Claims Against and Obligations of the Contractor or Subcontractor

1. The Contractor shall ensure that all its lawful obligations arising out of the performance of the Work are discharged and satisfied at least as often as the Contract requires Canada to pay the Contractor. The Contractor shall provide the Departmental Representative with a Statutory Declaration, as referred to in GC 5.2.2. If any third party claims and outstanding obligations exist under the Contract, a Statutory Declaration shall also be accompanied by letter documentation that clearly identifies the existence and condition of any third party disputed claims and outstanding obligations.
2. In order to discharge lawful obligations of and satisfy lawful claims against the Contractor or a Subcontractor arising out of the performance of the Work, Canada may:
 - (a) pay an amount from money that is due and payable to the Contractor pursuant to the Contract directly to the claimant against the Contractor or the Subcontractor; or
 - (b) withhold from any amount that is due and payable to the Contractor pursuant to the Contract the full amount of the claim or any portion thereof. Monies withheld for this purpose shall not be subject to any interest payment in the event such claims are rejected.
3. The amount referred to in GC 5.8.2 (a) shall be that amount which the Contractor would have been obliged to pay to such claimant had the provisions of the Provincial or Territorial lien legislation, or in the province of Quebec, the law relating to mortgage, been applicable to the Work. Any such claimant need not comply with the provisions of such legislation setting out the steps by way of notice, registration, or otherwise as might have been necessary to preserve or perfect any claim for lien or mortgage which the claimant might have had.
4. For the purposes of GC 5.8, a claim shall be considered lawful when it is so determined:
 - (a) by a court of competent jurisdiction;
 - (b) by an arbitrator duly appointed to arbitrate the said claim; or
 - (c) by written notice delivered to the Departmental Representative and signed by the Contractor authorizing payment of the said claim(s).
5. A payment made pursuant to GC 5.8.2 is, to the extent of the payment, a discharge of Canada's liability to the Contractor under the Contract and may be deducted from any amount payable to the Contractor under the Contract.
6. GC 5.8.2 shall only apply to claims and obligations where:
 - (a) the notification of which has set forth the amount claimed to be owing and the person who by Contract is primarily liable;
 - (b) the notification or a copy of the notification was received by the Departmental Representative in writing before final payment is made to the Contractor and within one hundred and twenty (120) days of the date on which the claimant:
 - (i) should have been paid in full under the claimant's Contract with the Contractor or Subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or
 - (ii) performed the last of the labour or furnished the last of the Plant or Material pursuant to the claimant's Contract with the Contractor or Subcontractor where the claim is not for money referred to in GC 5.8.6 (b)(i); and
 - (c) the proceedings to determine the right to payment for the claim shall have commenced within one year from the date that the notice referred to in GC 5.8.6 (b) was received by the Department Representative.
7. The Departmental Representative shall inform the Contractor in writing of receipt of any notification of claim and of the intention of Canada to withhold funds pursuant to GC 5.8.2. The Contractor may, at any time thereafter and until payment is made to the claimant, post with Canada, security in the form of a Claimant's Payment Bond acceptable to Canada and in an amount equal to the value of the said claim. Upon receipt of such security Canada shall release to the Contractor any funds which would be otherwise payable to the Contractor, that were withheld pursuant to the

provisions of GC 5.8.2.

GC 6 CHANGES IN THE WORK

GC 6.1 Changes in the Work

1. Canada shall have the right to order additional Work, dispense with, or change the whole or any part of the Work described in the Drawings and Specifications or Scope of the Work.
2. The Departmental Representative shall decide whether anything done or not done as a result of directions given under GC 6.1.1 has increased or decreased the cost of the Work to the Contractor and where the cost of the Work has increased or decreased, the amount payable under the Contract shall be increased or decreased by an amount calculated in accordance with GC5.7.
3. Any change in the terms of the Contract, other than changes that may be ordered by Canada or the Departmental Representative pursuant to GC 6.1.1, may be made only by agreement in writing between Canada and the Contractor.

GC 6.2 Changes in Subsurface Conditions and Delays by Canada

1. No extra payment shall be made to the Contractor for any extra expense, loss or damage for any reason unless Canada shall certify that such extra expense, loss or damage is directly attributable to:
 - (a) a substantial difference between the subsurface conditions as indicated in the Drawings and Specifications or Scope of Work and the actual conditions found at the site of the Work; or
 - (b) the neglect or delay by Canada, occurring after the date of award of the Contract:
 - (i) in providing any information or the doing of any act which Canada is required expressly by the Contract to do or as required by a known custom of the trade; or
 - (ii) in suspending the Work pursuant to GC 7.3.
2. The Contractor shall, within ten (10) days immediately after encountering such subsurface conditions or such neglect or delay, give written notice to the Departmental Representative of a claim for such extra expense, loss or damage. Failure to provide such written notice shall render the claim null and void.
3. The amount of any extra payment made under this section shall be calculated in accordance with GC 5.7.
4. If, in the opinion of the Departmental Representative, any difference in subsurface conditions referred to in GC 6.2.1 results in a savings to the Contractor, the amount of said savings shall be deducted from the Contract Amount owing to the Contractor.

GC 6.3 Extension of Time

1. Upon written application by the Contractor made before the date fixed for the completion of the Work, Canada may extend the time for completion of the Work if, in the opinion of Canada causes beyond the control of the Contractor have delayed its completion.
2. If the Contractor does not complete the Work by the day fixed for its completion, but completes it thereafter, the Contractor shall:
 - (a) pay all Canada's inspection costs relating to the Work incurred after the stipulated completion date; and
 - (b) compensate Canada for any loss or damage resulting from the failure by the Contractor to complete the Work by the completion date fixed by the Contract.Unless, in the opinion of Canada, such delay was due to causes beyond the control of the Contractor or it is in the public interest to waive the whole or any part of the payment.

GC 7 DEFAULT, SUSPENSION OR TERMINATION OF CONTRACT

GC 7.1 Taking the Work Out of the Contractor's Hands

1. By giving notice in writing to the Contractor, Canada may take all or any part of the Work out of the Contractor's hands, and may employ such means as Canada sees fit to have the Work completed if the Contractor:
 - (a) fails to remedy any delay in the commencement or default in the execution of the Work to the satisfaction of the Departmental Representative within six (6) days of Canada giving written notice to the Contractor to do so;
 - (b) defaults in the completion of any part of the Work within the time fixed by the Contract for its completion;
 - (c) becomes insolvent or commits an act of bankruptcy and has neither made a proposal to its creditors nor filed a notice of intention to make such a proposal pursuant to the *Bankruptcy and Insolvency Act*;
 - (d) abandons the Work;
 - (e) makes an assignment contrary to GC 1.3; and or
 - (f) otherwise fails to observe or perform any of the provisions of the Contract.
2. If the whole or any part of the Work is taken out of the Contractor's hands, the Contractor's right to any further payment that is due or accruing due under the Contract is extinguished.
3. The Contractor shall be liable to pay Canada, upon demand, an amount that is equal to the sum of all losses and damages incurred or sustained by Canada in respect of the Contractor's failure to complete the Work.
4. If the whole or any part of the Work that is taken out of the Contractor's hands pursuant to GC 7.1.1 is completed by Canada, the Departmental Representative shall calculate the amount, if any, of the holdback or progress claims that had accrued and was due prior to the date on which the Work was taken out of the Contractor's hands.
5. If it is determined that there is an amount that is not required for the purposes of having the Work performed or of compensating Canada for any other loss or damage incurred or sustained by reason of the Contractor's default, Canada may then pay the Contractor the amount determined not to be required pursuant to GC 7.1.4.

GC 7.2 Effect of Taking the Work Out of the Contractor's Hands

1. The taking of the Work or part thereof out of the Contractor's hands pursuant to GC 7.1.1 does not operate so as to relieve or discharge the Contractor from any obligations under the Contract or imposed upon the Contractor by law except the obligation to complete the performance of that part of the Work that was taken out of the Contractor's hands.
2. All Plant and Material and the interest of the Contractor in all real property, licenses, powers and privileges acquired, used, provided or consumed by the Contractor under the Contract shall continue to be the property of Canada without compensation to the Contractor.
3. When the Departmental Representative certifies that any Plant, Material or any interest of the Contractor referred to in GC 7.2, is no longer required for the purpose of the Work, or that it is not in the interests of Canada to retain that Plant, Material or interest, it shall revert to the Contractor.

GC 7.3 Suspension of the Contract

1. Canada may, upon giving notice in writing to the Contractor, suspend the performance of the Work at any time. The Contractor shall comply with such notice immediately, subject to any conditions that may be stipulated in the notice.
2. If Canada suspends the Work for thirty (30) days or less the Contractor shall, subject to its remedy under GC 5.7, complete the Work when called upon to do so. If Canada suspends the Work for a period in excess of thirty (30) days, the Contractor may request that Canada terminate the Contract pursuant to GC 7.4.
3. It is the responsibility of the Contractor to mitigate all costs during the suspension period.

GC 7.4 Termination of the Contract

1. Canada may terminate the Contract at any time by giving notice of termination in writing to the Contractor and upon receipt of such notice the Contractor shall cease all operations in performance of the Contract, subject to any conditions that may be stipulated in the notice.
2. Termination under GC 7.4.1 shall not relieve the Contractor of any legal or contractual obligations other than that

portion of Work that remains to be completed at the time of the termination.

3. Payment, in event of termination under this subsection, shall be made pursuant to the provision of GC 5.5.

GC 8 DISPUTE RESOLUTION

1. The Contractor may, within 10 days after the communication to the Contractor of any decision or direction referred to in GC2.1(b) and GC6.1, protest that decision or direction.
2. A protest referred to in GC8.1 shall be in writing, contain full reasons for the protest, be signed by the Contractor and be given to Canada.
3. If the Contractor gives a protest pursuant to GC8.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction, or prevent the Contractor from taking whatever action the Contractor considers appropriate in the circumstances.
4. The giving of a protest by the Contractor pursuant to GC8.2 shall not relieve the Contractor from complying with the decision or direction that is the subject of the protest.
5. Subject to GC8.6, the Contractor shall take any action referred to in GC8.3 within 3 months after the date of the Certificate of Completion referred to in GC5.6 and not afterwards, except where it is otherwise provided by law.
6. The Contractor shall take any action referred to in GC8.3 resulting from a direction under GC3.4, within 3 months after the expiry of a warranty or guarantee period and not afterwards, except where it is otherwise provided by law.
7. Subject to GC8.8, if Canada determines that the Contractor's protest is justified, Canada shall pay the Contractor the cost of the additional labour, Plant and Material necessarily incurred by the Contractor in carrying out the protested decision or direction.
8. Costs referred to in GC8.7 shall be calculated in accordance with GC5.7.

GC 9 INDEMNIFICATION AND INSURANCE

GC 9.1 Indemnification

1. The Contractor shall indemnify and save harmless Canada, its servants, agents and all those for whom Canada may be, in law, responsible, from and against all claims, demands, losses, damages, costs and legal proceedings by whomever made, sustained, brought or prosecuted, and in any manner based upon, occasioned by or attributed to the activities of the Contractor, the Contractor's employees, agents or persons for whom the Contractor is, in law, responsible for the performance or purported performance of the Contract, including an infringement or alleged infringement of a patent of invention or any other kind of intellectual property.
2. For the purpose of GC 9.1.1, activities include any act improperly carried out and any omission or delay in carrying out an act.
3. The Contractor's liability to indemnify or reimburse Canada under the Contract shall not affect or prejudice Canada from exercising any rights available to Canada at law or in equity.

GC 9.2 Insurance Contracts

1. The Contractor shall, at the Contractor's expense, obtain and maintain insurance contracts in respect of the work and shall provide evidence thereof to Canada in accordance with the requirements of the INSURANCE TERMS.
2. The insurance contracts referred to in GC 9.2.1 shall:
 - (a) be in a form, of the nature, in the amounts, for the periods and containing the terms and conditions specified in INSURANCE TERMS; and
 - (b) provide for the payment of claims under such insurance contracts in accordance with GC 9.3.

GC 9.3 Insurance Proceeds

1. In the case of a claim payable under a Builders Risk/Installation (All Risks) insurance contract maintained by the Contractor pursuant to GC 9.2, the proceeds of the claim shall be paid directly to Canada, and
 - (a) the monies so paid shall be held by Canada for the purposes of the Contract, or
 - (b) if Canada elects, shall be retained by Canada, in which event they vest in Canada absolutely.
2. In the case of a claim payable under a General Liability insurance contract maintained by the Contractor pursuant to GC 9.2, the proceeds of the claim shall be paid by the insurer directly to the claimant.
3. If an election is made pursuant to GC 9.3.1, Canada may cause an audit to be made of the accounts of the Contractor and of Canada in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between
 - (a) the aggregate of the amount of the loss or damage suffered or sustained by Canada, including any costs incurred in respect of the clearing and cleaning of the Work and its site and any other amount that is payable by the Contractor to Canada under the Contract, minus any monies retained pursuant to GC 9.3.1 (b); and
 - (b) the aggregate of the amounts payable by Canada to the Contractor pursuant to the Contract up to the date of the loss or damage.
4. A difference that is established pursuant to GC 9.3.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the creditor.
5. When payment of a deficiency has been made pursuant to GC 9.3.4, all rights and obligations of Canada and the Contractor under the Contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC 9.3.3, be deemed to have been expended and discharged.
6. If an election is not made pursuant to GC 9.3.1 (b), the Contractor shall, subject to GC 9.3.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at the Contractor's expense as if that part of the work had not yet been performed.
7. When the Contractor clears and cleans the Work and its site and restores and replaces the work referred to in GC 9.3.6, Canada shall pay the Contractor out of the monies referred to in GC 9.3.1 so far as they will thereon to extend.
8. Subject to GC 9.3.7, payment by Canada pursuant to GC 9.3.7 shall be made in accordance with the Contract but the amount of each payment shall be 100 percent of the amount claimed notwithstanding GC 5.3 a) and b).

INSURANCE TERMS

IN1 GENERAL

- IN1.1 Worker's Compensation
- IN1.2 Indemnification
- IN1.3 Proof of Insurance
- IN1.4 Insured
- IN1.5 Payment of Deductible

IN2 COMMERCIAL GENERAL LIABILITY

- IN2.1 Scope of Policy
- IN2.2 Period of Insurance

IN3 AUTOMOBILE INSURANCE

- IN3.1 Scope of Policy

IN4 BUILDER'S RISK / INSTALLATION FLOATER

- IN4.1 Scope of Policy
- IN4.2 Amount of Insurance
- IN4.3 Period of Insurance
- IN4.4 Insurance Proceeds

IN1 GENERAL

IN1.1 Worker's Compensation

- 1) The Contractor shall provide and maintain Worker's Compensation Insurance in accordance with the legal requirements of the Province or Territory where the work is being carried out.

IN1.2 Indemnification

- 1) The insurance required by the provisions of these Insurance Terms shall in no way limit the Contractor's responsibility under the Indemnification clause of the General Conditions of the contract. Any additional coverage the Contractor may deem necessary to fulfill his obligations under the aforesaid clause shall be at his own discretion and expense.

IN1.3 Proof of Insurance

- 1) Before commencement of the Work, and within thirty (30) days after acceptance of its bid, the Contractor shall deposit with Canada a CERTIFICATE OF INSURANCE (form AAFC / AAC5314) available upon request.
- 2) Upon request by Canada, the Contractor shall provide originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the provisions contained herein.

IN1.4 Insured

- 1) Each policy shall insure the Contractor and shall include Her Majesty the Queen in right of Canada, represented by the Minister of Agriculture & Agri-Food Canada as an additional Insured, with respect to liability arising out of the operations of the contractor with regard to the work.

IN1.5 Payment of Deductible

- 1) The payment of monies up to the deductible amount made in satisfaction of a claim shall be borne by the Contractor.

IN2 COMMERCIAL GENERAL LIABILITY

IN2.1 Scope of Policy

- 1) The insurance coverage provided shall not be less than that provided by IBC Form 2100, as amended from time to time, and shall have:
 - (a) an Each Occurrence Limit of not less than \$1,000,000.00 ;
 - (b) a Products/Completed Operations Aggregate Limit of not less than \$1,000,000.00 ; and
 - (c) a General Aggregate Limit of not less than \$2,000,000.00 per policy year, if the policy is subject to such a limit.
- 2) The policy shall either include or be endorsed to include coverage for the following exposures or hazards if the Work is subject thereto:
 - (a) Blasting.
 - (b) Pile driving and caisson work.
 - (c) Underpinning.
 - (d) Removal or weakening of support of any building or land whether such support be natural or otherwise if the work is performed by the insured contractor.
 - (e) Asbestos.
 - (f) Non-owned Automobile Policy.

IN2.2 Period of Insurance

- 1) Unless otherwise directed in writing by Canada, or, otherwise stipulated elsewhere herein, the policy required herein shall be in force and be maintained from the date of contract award until the day of issue of the Certificate of Completion except that the coverage for Completed Operations Liability shall, in any event, be maintained for a period of at least six (6) years beyond the date of the CERTIFICATE OF COMPLETION.

IN3 AUTOMOBILE INSURANCE

IN3.1 Scope of Policy

- 1) Automobile Liability Insurance in respect of licensed vehicles shall have limits of not less than one million dollars inclusive per occurrence for bodily injury, death, and damage to property.

IN4 BUILDER'S RISK / INSTALLATION FLOATER

IN4.1 Scope of Policy

- 1) The insurance coverage provided by a Builder's Risk policy or an Installation Floater policy shall not be less than that provided by IBC Forms 4042 and 4047, as amended from time to time.
- 2) The policy shall permit use and occupancy of the project, or any part thereof, where such use and occupancy is for the purposes for which the project is intended upon completion.
- 3) The policy may exclude or be endorsed to exclude coverage for loss or damage caused by any of the following:
 - (a) Asbestos.
 - (b) Fungi or spores.
 - (c) Cyber.
 - (d) Terrorism.

IN4.2 Amount of Insurance

- 1) The amount of insurance shall not be less than the sum of the contract value plus the declared value (if any) set forth in the contract documents of all material and equipment supplied by Canada at the site of the project to be incorporated into and form part of the finished Work. If the value of the Work is changed, the policy shall be changed to reflect the revised contract value.

IN4.3 Period of Insurance

- 1) Unless otherwise directed in writing by Canada, or, stipulated elsewhere herein, the policy required herein shall be in force and be maintained from prior to the commencement of work until the day of issue of the CERTIFICATE OF COMPLETION.

IN4.4 Insurance Proceeds

- 1) The policy shall provide that the proceeds thereof are payable to Her Majesty or as Canada may direct in accordance with GC 9.3 Insurance Proceeds.
- 2) The Contractor shall, without delay, do such things and execute such documents as are necessary to effect payment of the proceeds.

BID AND ACCEPTANCE FORM
CONSTRUCTION CONTRACT - MINOR WORKS

Solicitation / File Number: 16-1307
Project:
Contract:

MAIL OR DELIVER BID TO:
Central Experimental Farm
KW Neatby Building, Main Entrance
960 Carling Ave
Ottawa, ON
K1A 0C6

BID CLOSING TIME:
Tuesday, December 20, 2016
Day of week, Month, Day, Year
at 02:00 AM PM local time.

DESCRIPTION OF WORKS:
Replacement of Irrigation Pumps CEF Building Building 84

INSTRUCTIONS TO BIDDERS:

Bidders shall be governed by the following instructions:

- SPECIAL INSTRUCTIONS TO BIDDERS - Form AAFC / AAC5318-E
- INSTRUCTIONS TO BIDDERS - Form AAFC / AAC5319-E

The following additional documents form an attachment to this BID AND ACCEPTANCE FORM:

OFFER AND AGREEMENT

1. The undersigned bidder (hereinafter called the "Contractor") hereby offers to Her Majesty the Queen in right of Canada, as represented by the Minister of Agriculture and Agri-Food (hereinafter called "Canada"), to furnish all necessary labour, plant and material and to execute and complete in a satisfactory and workmanlike manner all the work required under this contract for the consideration of the unit or lump sum price or prices set forth in the Price Table below. The Contractor agrees that these prices include all applicable provincial sales taxes, ancillary taxes and any commodity tax. Note: Do not include Applicable Taxes (GST/HST/QST) as defined in the General Conditions in price(s).

PRICE TABLE					
Item	Class of Labour, Plant, or Material	Unit of Measurement	Estimated Total Quantity	Price Per Unit	Estimated Total Price
01	Replacement of irrigation pumps - CEF Building 84	EA	1		
NOTE: Both price per unit and estimated total price must be filled in for each item in the Price Table. All estimated total prices will be subject to verification by Canada. In case of variation between the price per unit and the estimated total price, the price per unit will be considered to be the price bid.				Total Bid	

2. The Contractor shall perform and complete the Work on or before 2017-03-31.
3. The Contractor hereby acknowledges receipt of the following addenda to the bid documents (give number and date of each):
Addenda numbers: _____ Dates: _____
4. The Contractor agrees that this offer: supersedes and cancels all communications, negotiations, and agreements relating to the work other than contained in this completed bid or any amendment incorporated by mutual agreement between the Contractor and Canada before acceptance of this Offer and Agreement; is irrevocable for 30 days after the Bid Closing Time shown hereon.
5. The Contractor agrees, that the complete bid together with and subject to all the provisions contained herein shall, when accepted and executed on behalf of Canada, constitute a binding contract between the Contractor and Canada.
6. The following additional documents form an attachment to a binding contract:
 - 6.1 GENERAL CONDITIONS FOR MINOR WORKS - Form AAFC / AAC5316-E
 - 6.2 Specifications
 - 6.3 Insurance Terms

CONTRACTOR'S FULL BUSINESS NAME (Please print or type)

CONTRACTOR'S BUSINESS ADDRESS (for all purposes of or incidental to the contract)

Unit/Suite/Apt.	Street number	Number suffix	Street name	Street type	Street direction
PO Box or Route Number		Municipality (City, Town, etc.)		Province	Postal code
Telephone number	Ext.	Facsimile number	E-mail (optional)	GST/HST number	

Attested to and Delivered on Behalf of the Contractor this _____ day of _____, _____.
Month Year

CONTRACTOR'S or, where applicable,
SIGNING OFFICER'S SIGNATURE(S)

TITLE(S)

In the presence of:
WITNESS SIGNATURE(S)

NOTE: Corporate Firms shall affix their Corporate Seal if applicable.

(FOR DEPARTMENTAL USE ONLY)

Accepted and Executed on Behalf of Canada this _____ day of _____, _____.
Month Year

SIGNATURE

TITLE

In the presence of: WITNESS SIGNATURE

Bid opened in _____ on _____, _____ at _____ AM PM local time.
Location Day of week Month Day Year

in the presence of _____

INTEGRITY PROVISIONS - LIST OF NAMES
(complete if your bid exceeds \$10,000.00)

If the required list of names has not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to provide the names within the time frame specified will render the bid non-responsive. Providing the required names is a mandatory requirement for contract award.

Bidders who are incorporated, including those bidding as a joint venture, must provide a complete list of names of all individuals who are currently directors of the Bidder.

Bidders bidding as sole proprietorship, as well as those bidding as a joint venture, must provide the name of the owner(s).

Bidders bidding as societies, firms or partnerships do not need to provide lists of names.



Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

DRAWINGS AND SPECIFICATIONS

#16-1307

FOR

REPLACEMENT OF IRRIGATION PUMPS

BUILDING 84

PROJECT: CEF160012

**CENTRAL EXPERIMENTAL FARM (CEF)
Agriculture and Agri-Food Canada (AAFC)
K.W. Neatby building
960 Carling Avenue
Ottawa, Ontario K1A 0C6**

CEF160012

SPECIFICATIONS:

<i>Section No.</i>	<i>Section Title</i>	<i>Pages</i>
DIVISION 01	GENERAL REQUIREMENTS	
01 00 10	General instructions	5
01 91 13	General Commissioning (Cx) Requirements	8
01 91 33	Commissioning (Cx) Forms	3
DIVISION 21	FIRE SUPPRESSION	
21 05 01	Common Work Results for Mechanical	3
DIVISION 22	PLUMBING	
22 05 00	Common Work Results for Plumbing	3
22 11 23	Pumps	18
DIVISION 23	HVAC	
23 05 05	Installation of Pipework	4
23 05 23	Valves – Cast Iron	4
23 05 54	Mechanical Identification	5
DIVISION 26	ELECTRICAL	
26 05 00	Electrical General Requirements	6
26 05 20	Wire and Box Connectors (0-1000V)	1
26 05 21	Wires and Cables (0-1000V)	2
26 05 28	Grounding - Secondary	2
26 05 34	Conduits, Conduit Fastenings, and Conduit Fittings	3

PLANS:

<i>Dwg.No.</i>	<i>Drawing Title</i>
Mechanical:	M-1 Pump replacement

END OF SECTION

Part 1 General

1.1 MINIMUM STANDARDS

- .1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada 2010 (NBC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.

1.2 PRECEDENCE

1.3 SITE LOCATES AND CLEARANCE NUMBERS

- .1 Be responsible for all costs associated with obtaining site locates or clearance numbers for all utilities within the work area, including those utilities considered privately owned.
- .2 Engage the services of private locator firm to undertake the private locates. All known locations of Federal underground utilities (“private utilities”) are indicated in the contract documents.
- .3 Provide copies of written correspondence from each respective underground utility agencies pertaining to their utility locates or work site clearance numbers.

1.4 TAXES

- .1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.5 FEES, PERMITS, AND CERTIFICATES

- .1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.6 FIRE SAFETY REQUIREMENTS

- .1 Comply with the National Building Code of Canada 2010 (NBC) for fire safety in construction and the National Fire Code of Canada 2010 (NFC) for fire prevention, fire fighting and life safety in building in use.

1.7 HAZARDOUS MATERIALS

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.
- .2 For work in occupied buildings give the Departmental Representative 48 hours notice for work involving designated substances (Ontario Bill 208), hazardous substances (Canada Labour Code Part II Section 10)

1.8 WELDING AND CUTTING

- .1 At least 48 hours prior to commencing cutting or welding, provide to Departmental Representative:

- .1 Completed welding permit.
- .2 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.
- .3 A firewatcher shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 10m may be ignited by conduction or radiation.

1.9 FIELD QUALITY CONTROL

- .1 Carry out Work using qualified licensed workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.
- .2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licensed workers.
- .3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.10 TEMPORARY UTILITIES

- .1 Existing services required for the work, are not to be used by the Contractor. Contractor responsible to supply all portable generators as required to meet all power requirements of the equipment and machinery required to undertake the work.
- .2 All water requirements for execution of this contract are the responsibility of the contractor to provide from off-site sources.

1.11 REMOVED MATERIALS

- .1 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from site.

1.12 PROTECTION

- .1 Protect adjacent work against the spread of dust and dirt beyond the work areas.
- .2 Protect finished work against damage until take-over.
- .3 Protect operatives and other users of site from all hazards.

1.13 HOARDING

- .1 Erect temporary site enclosure around work site, including excavations.
- .2 Hoarding to be in full compliance with requirements of the Ontario Health and Safety Act and Regulations - 1990 (OHSA).
 - .1 Hoarding around the work site shall consist of: new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4m o.c. complete with 2x4 lumber support for top of fence.
 - .2 In accordance with OHSA, where required, provide 1.8m high sturdy fence to protect personnel from hazards.
- .3 Keep site fenced off at all times from general public. Only remove portion of fence to provide opening to site to accommodate access, minimize duration of opening, and immediately close when not required.
- .4 Ensure site is fully enclosed when work force is not on site.
- .5 Continually monitor condition of hoarding and make good repairs.

1.14 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to the normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access, including emergency vehicles.
- .3 Maintain vehicle and pedestrian access, including emergency vehicles to and from the site.
- .4 Where security is reduced by work provide temporary means to maintain security.

1.15 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Location of portable facility to be approved by Departmental Representative on site.

1.16 SITE STORAGE

- .1 Storage and stockpile areas shall be equipped and maintained by the contractor.
 - .1 Storage and stockpile areas are to be contained entirely within the laydown/work area indicated.
 - .2 Contractor employee parking shall be contained within the indicated laydown/work area
- .2 Do not unreasonably encumber site with materials or equipment.
- .3 Move stored products or equipment, which interfere with operations of Departmental Representative or other contractors.
- .4 Obtain and pay for use of additional storage or work areas needed for operations.

1.17 CUT, PATCH AND MAKE GOOD

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove all items so shown or specified.
- .3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.

1.18 EXAMINATION

- .1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.

1.19 SIGNS

- .1 Provide common-use signs related to traffic control, information, instruction, use of equipment, public safety devices, etcetera, in both official languages or by the use of commonly understood graphic symbols to the Departmental Representative's approval.

- .2 No advertising will be permitted on this project.

1.20 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.21 BUILDING SMOKING ENVIRONMENT

- .1 Smoking is not permitted in the Building. Obey smoking restrictions on building property.

1.22 DUST CONTROL

- .1 Prevent the spread of dust for the protection of workers, finished areas of work and public.

1.23 TESTING LABORATORY SERVICES

- .1 Departmental Representative will appoint and pay for costs of inspection and testing services, unless indicated otherwise.
- .2 Provide safe working areas and assist with testing procedures, including provisions for materials or services and co-ordination, as required by testing agency and as authorized by Departmental Representative.
- .3 Where tests indicate non-compliance with specifications, contractor to pay for initial test and all subsequent testing of work to verify acceptability of corrected work.

1.24 SCHEDULING

- .1 On award of contract submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When schedule has been reviewed by the Departmental Representative, take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.
- .2 Carry out work during "regular hour" Monday to Friday from 07:00 to 18:00 hours, unless otherwise indicated.
- .3 Carry out the following work during "off hours", as defined as Monday to Friday from 18:00 to 07:00 hours and anytime on Saturdays, Sundays, and statutory holidays:
 - .1 Building service interruptions.
 - .2 Connections of new water main to live water mains.
- .4 Give the Departmental Representative 96 hours notice for work to be carried out during "off hours".

1.25 COST BREAKDOWN

- .1 Before submitting first progress claim submit breakdown of Contract Amount in detail as directed by Departmental Representative and aggregating the Contract Amount. After approval by Departmental Representative cost breakdown will be used as the basis of progress payments.

- Part 2** **Products**
- 2.1 **NOT USED**

- Part 3** **Execution**
- 3.1 **NOT USED**

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting, and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be used interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.
- .4 For AFD-managed projects, the term Departmental Representative in Cx specifications to be interpreted as AFD Service Provider.

1.3 COMMISSIONING OVERVIEW

- .1 Cx to be a line item of Contractor's cost breakdown.
- .2 Cx activities supplement field quality and testing procedures described in relevant technical sections.

- .3 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental, and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.
- .4 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components, and systems have been commissioned.
 - .3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Departmental Representative to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

- .1
 - .1 Submit no later than four (4) weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least eight (8) weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least eight (8) weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process as required by[Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings.
- .2 Purpose: To resolve issues, monitor progress, and identify deficiencies relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage, Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities, and prepare for Cx. Issues at meeting to include:

- .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
- .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter, Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide fourteen (14) days notice prior to commencement.
- .2 Departmental Representative to witness of start-up and testing.
- .3 .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Not used.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

- .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
- .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
- .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be removed from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer, develop written maintenance program and submit to Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 Notify Departmental Representative at least twenty-one (21) days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing, or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Departmental Representative within ten (10) days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

.1 Not used.

1.24 EXTRAPOLATION OF RESULTS

.1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

.1 Number and location to be at discretion of Departmental Representative.

.2 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.3 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.4 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes that become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults, or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 TRAINING

- .1 Not used.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.

- .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.36 OWNER'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system, and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up checklists are acceptable for use. As deemed necessary by Departmental Representative, supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document checklist verifying checks have been made; indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

- .1 Not used

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

- .1 When additional forms are required, but are not available from Departmental Representative, develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by Departmental Representative.

1.7 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Departmental Representative may provide Contractor with project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.
 - .13 Forms to be both hard copy and electronic format with typed-written results in Building Management Manual.

1.8 LANGUAGE

- .1 To suit the language profile of the awarded contract.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General**1.1 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 00 10 – General Instructions.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Engineer 2 weeks before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include: Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .1 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .6 Approvals:

COMMON WORK RESULTS FOR MECHANICAL

- .1 Submit 3 copies of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.
- .2 Make changes as required and re-submit as directed by Engineer.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Engineer will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Use different colour waterproof ink for each service.
 - .3 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Engineer for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 00 10 – General Instructions.

1.3 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 00 10 – General Instructions.

Part 2 Products**2.1 MATERIALS**

- .1 Materials and products in accordance with Section 01 00 10 – General Instructions.

Part 3 Execution**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 01 00 10 – General Instructions.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 00 10 – General Instructions .
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work.

3.4 DEMONSTRATION

- .1 Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

- .6 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Departmental Representative will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting, and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) and (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting, and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 N/A

Part 3 Execution

3.1 CLEANING

.1 Clean interior and exterior of all systems.

3.2 DEMONSTRATION

.1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 City water booster pump system.

.3 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting, and servicing of all systems and equipment during regular work hours and prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Departmental Representative may record these demonstrations on videotape for future reference.

3.3 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Variable Speed Pumping Package
- .2 Pump Control Panel
- .3 Variable Frequency Drive
- .4 Sensor Transmitters
- .5 Sequence of Operation

1.2 REFERENCES

- .1 AWWA - American Water Works Association
- .2 ANSI - American National Standards Institute
- .3 ASTM - American Standards for Testing Materials
- .4 HI - Hydraulic Institute
- .5 ASME - American Society of Mechanical Engineers
- .6 UL - Underwriters Laboratories
- .7 ISO - International Standards Organization
- .8 NEMA - National Electrical Manufacturers Association
- .9 ETL - Electrical Testing Laboratories
- .10 CSA - Canadian Standards Association
- .11 NEC - National Electrical Code
- .12 IEC - International Electrotechnical Commission
- .13 NSF – NSF International
- .14 ISO – International Organization for Standardization
- .15 ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers

1.3 SUBMITTALS

SUBMITTALS SHALL INCLUDE THE FOLLOWING:

- .1 System summary sheet.
- .2 Sequence of operation.
- .3 Shop drawing indicating dimensions, required clearances and location and size of each field connection and anchoring detail.
- .4 Power and control wiring diagrams.
- .5 System profile analysis including variable speed pump curves and system curve. The analysis shall also include pump & motor efficiencies, staging points, job specific load profile, horsepower and kilowatt/hour consumption.
- .6 Pump data sheets.

- .7 Submittals must be specific to this project. Generic submittals will not be accepted.
- .8 Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.

1.4 QUALITY ASSURANCE

- .1 The pumping package shall be assembled by the pump manufacturer. An assembler of pumping systems not actively engaged in the design and construction of centrifugal pumps shall not be considered a pump manufacturer. The manufacturer shall assume "Unit Responsibility" for the complete pumping package. Unit responsibility shall be defined as responsibility for interface and successful operation of all system components supplied by the pumping system manufacturer.
- .2 The pumping system shall be factory tested to the job-specific condition points prior to shipment. A check test procedure shall be conducted with motors connected to VFD output / motor starters (VFD output if VS) and it shall test all inputs, outputs, and program execution specific to this application, including presetting of all job specific program parameters.
- .3 Bidders shall comply with all sections of this specification relating to packaged pumping systems. Any deviations from this specification shall be bid as a voluntary alternate clearly defined in writing. If no exceptions are noted, the supplier or contractor shall be bound by these specifications.
- .4 A copy of manufacturer's certificate of insurance shall be made available upon request showing as a minimum, general liability coverage of \$1,000,000, and an excess liability coverage of \$10,000,000.
- .5 The pumping package shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 for potable drinking water and NSF-61 Annex G for low lead content.
- .6 Manufacturer shall be listed by UL as a manufacturer of packaged pumping systems under UL/cUL category QCZJ.
 - .7 Manufacturer shall be listed by UL as a manufacturer of control panels under UL 508A.
- .8 The manufacturer's production facility shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 and NSF-61 Annex G. The manufacturing facility shall be subjected to periodic inspections and audits.

Part 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- .1 All selection submissions for each pump set manufacturer are subject to compliance with these specifications, and must be pre-approved by and to the satisfaction of the Departmental Representative prior to tender.

2.2 MANUFACTURED UNITS

- .1 Furnish and install, as shown on the plans, a VSD-driven pump set. Performance as indicated on drawings.

- .2 Double Suction, Horizontal Split Case Pump (Base Mounted):

1. The pumps shall be long coupled, base mounted, single stage, double suction, horizontally split case design, in cast iron bronze fitted construction specifically designed for quiet operation. Suitable standard operations at 225

F and 175 PSIG work
 F and 280 or 400

operations at up to 250

Working pressures shall not be de-rated at temperatures up to 250F. The pump internals shall be capable of being serviced without disturbing piping connections or electrical motor connections, and the pump's internal seals and bearings shall be serviceable without disturbing the upper casing half.

2. A bearing housing shall supply support for a pair of heavy-duty regreaseable ball bearings designed to circulate in oil. An inboard single row bearing shall absorb thermal expansive forces while an outboard double row bearing shall be clamped in place to absorb both radial and thrust loads and keep the rotating element in proper axial alignment. Bearings shall be replaceable without disturbing the system piping, the upper casing half, and shall be regreaseable without removal of the bearings from the bearing housing.
3. The impeller shaft shall be a solid 416 stainless steel shaft.
4. Pump shall be equipped with a pair of internally self flushing mechanical seal assemblies in direct contact with the pump shaft. Seal assemblies shall be a John Crane 21 BF(50) 10(10)1, having a brass housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon Ni-Resist design with the carbon face rotating against a stationary Ni-Resist face. Mechanical seals shall be replaceable without disturbing the upper casing half and system piping.
5. Impeller shall be of the enclosed double suction type made of bronze, both hydraulically and dynamically balanced to ANSI/HI 1.1-1.5-1994, section 1.4.6.1.3, figure 1.106, balance grade G6.3, keyed to the shaft and fixed in the axial position.
6. A flexible type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor. On variable speed applications the coupler sleeve should be constructed of an EPDM material to maximize performance life.
7. An OSHA and ANSI rated coupler guard shall shield the coupler during operation. Coupler guard shall be dual rated ANSI B15.1, Section 8 and OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling. No more than .25 inches of either rotating assembly shall be visible beyond the coupling guard.

8. Pump volute shall be of a cast iron (rated for 175 PSIG maximum working pressure) or ductile iron (rated for 280 or 400 PSIG maximum working pressure) axially-split design with flanges (175 PSIG drilled for 125# ANSI companion flanges or optional 280 and 400 PSIG working pressures are drilled 250# flange drilled) and mounting feet integral cast into the bottom half of the casing. Suction and discharge flanges shall be on a common centerline in both the horizontal and vertical planes, and the volute shall include Bronze Casing Wear Rings, priming port, gauge ports at nozzles, and vent and drain ports. The upper half casing shall be capable of being removed without disturbing piping connections or electrical motor connections.
9. On pumps rated for 175 PSIG the pump seal flushing shall be internal within the pump casing and shall flush the seal at a rate equal to 25% of the total pump flow. On pumps rated for 280 or 400 PSIG the pump seal flushing shall be external and use flushing lines made of bronze that shall be mounted on the upper half pump casing.
10. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACT 92.
11. Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts and not press fit components
12. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI 1.3.4-1997 for *Horizontal Baseplate Design* standards.
13. Pump rotation shall be right-hand or left-hand as viewed from the pump's motor end and in respect to the discharge flange.
14. The pump(s) selected shall conform to ANSI/HI 9.6.3.1 standards for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI 9.6.1-1997 standards for *Centrifugal and Vertical Pumps for NPSH Margin*.
15. The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 1.1-1.5-1994, section 1.4.6.1.1 for recommended acceptable unfiltered field vibration limits (as measured per H.I. 1.4.6.5.2) for pumps with rolling contact bearings.
16. Pump manufacturer shall be ISO-9001 certified.
17. The seismic capability of the pump shall allow it to withstand a horizontal load of 0.5g, excluding piping and/or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting pump operation.
18. Each pump shall be factory hydrostatically tested per Hydraulic Institute standards and name-plated before shipment. It shall then be thoroughly cleaned and painted with at least one coat of high grade paint prior to shipment.
19. Base shall be capable of being field grouted.
20. Pumps to be supplied with electric motors suitable for VSD control.

2.3 COMPONENTS

.1 VARIABLE FREQUENCY DRIVE

.1 Description:

- .1 This specification covers complete variable frequency drives (VFDs) designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD panel.
- .2 The VFD shall be rated NEMA 12. Manufacturer shall supply a copy of the UL plenum evaluation upon request.
- .3 The VFD shall be tested to UL 508C. The appropriate UL label shall be applied. When the VFDs are to be located in Canada, C-UL certifications shall apply. VFD shall be manufactured in ISO 9001, 2000 certified facilities.
- .4 The VFD shall be UL listed for a short circuit current rating of 100 kA and labeled with this rating.
- .5 The VFD manufacturer shall supply the VFD and all necessary controls as herein specified.

.2 Components:

- .1 The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor de-rating.
- .2 When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- .3 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.
- .4 The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with saturating (non-linear) DC link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.
- .5 VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.
- .6 A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.

- .7 Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.
 - .8 An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.
 - .9 Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.
 - .10 VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.
- .3 Protective Features:
- .1 A minimum of Class 20 I2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.
 - .2 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.
 - .3 Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.
 - .4 Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.
 - .5 Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.
 - .6 The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.
 - .7 VFD shall include a "signal loss detection" algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.
 - .8 VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.

- .9 VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.
 - .10 Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.
 - .11 VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.
 - .12 If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD's temperature becomes too high.
 - .13 In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.
 - .14 The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.
 - .15 The VFD shall store in memory the last ten (10) alarms. A description of the alarm, and the date and time of the alarm shall be recorded.
 - .16 When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.
- .4 Interior Features:
- .1 Hand, Off and Auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.
 - .2 There shall be an "Info" key on the keypad. The Info key shall include "on-line" context sensitive assistance for programming and troubleshooting.
 - .3 The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in Hand or Auto mode. This is to alert the Building Automation System whether the VFD is being controlled locally or by the Building Automation System.
 - .4 Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.
 - .5 All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.
 - .6 To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from

- the keypad only size independent parameters. Keypad shall provide visual indication of copy status.
- .7 Display shall be programmable to communicate in English and French.
 - .8 A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
 - .9 A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual Fan, Pump, and Compressor menus specifically designed to facilitate start-up of these applications.
 - .10 The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor, which is located near the output of the pump rather than out in the controlled system.
 - .11 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
 - .12 Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, actual process variable and set point among others.
 - .13 Programmable Sleep Mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into Sleep Mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.
 - .14 A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.
 - .15 VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (°F).
 - .16 VFD shall be programmable to sense the loss of load. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.
- .5 Standard Inputs and Outputs:
- .1 Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

- .2 Two terminals shall be programmable to act either as digital outputs or additional digital inputs.
- .3 Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.
 - .1 Each relay shall have an adjustable on delay / off delay time.
- .4 Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.
 - .1 Each shall be independently selectable to be used with either an analog voltage or current signal.
 - .2 The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.
 - .3 A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.
 - .4 The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,
- .5 One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.
- .6 It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.
- .7 It shall be possible to command all digital and analog output through the serial communication bus.
- .8 Optional Control and Monitoring Inputs and Outputs:
 - .1 It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.
 - .2 These modules shall use rigid connectors to plug into the VFD's control card.
 - .3 The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.
 - .4 Modules may include such items as:
 - .1 Additional digital outputs, including relay outputs.
 - .2 Additional digital inputs.
 - .3 Additional analog outputs.
 - .4 Additional analog inputs, including Ni or Pt temperature sensor inputs.
- .9 It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.
- .10 A real-time clock shall be an integral part of the VFD.
- .11 It shall be possible to use this to display the current date and time on the VFD's display.
- .12 Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints

- and output relays. It shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.
- .13 All VFD faults shall be time stamped to aid troubleshooting.
 - .14 It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.
 - .15 The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.
 - .16 The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.
 - .17 The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:
 - .1 Comparators for comparing VFD analog values to programmed trigger values.
 - .2 Logic operators to combine up to three logic expressions using Boolean algebra.
 - .3 Delay timers.
 - .4 A 20-step programmable structure.
 - .18 The VFD shall include a cascade controller which allows the VFD to operate in closed loop set point (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.
- .6 Serial Communications
- .1 The VFD shall include a standard EIA-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:
 - .1 Johnson Controls Metasys N2.
 - .2 Modbus RTU.
 - .3 BACnet MS/TP.
 - .2 VFD shall have standard USB port for direct connection of Personal Computer (PC) to the VFD. The manufacturer shall provide no-charge PC software to allow complete setup and access of the VFD and logs of VFD operation through the USB port. It shall be possible to communicate to the VFD through this USB port without interrupting VFD communications to the building management system.
 - .3 The VFD shall have provisions for an optional 24 volt DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.
- .7 Adjustments
- .1 The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 kHz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.

- .2 Four independent setups shall be provided.
 - .3 Four preset speeds per setup shall be provided for a total of 16.
 - .4 Each setup shall have two programmable ramp-up and ramp-down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.
 - .5 Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer, which will cause the VFD to trip off after a programmed time period.
 - .6 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.
 - .7 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
 - .8 An automatic “start delay” may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.
 - .9 Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.
- .8 Service Conditions
- .1 Ambient temperature, continuous, full speed, full load operation:
 - .1 -10 to 45°C through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt
 - .2 -10 to 40°C 150 HP and larger
 - .2 0 to 95% relative humidity, non-condensing.
 - .3 Elevation to 1,000m without derating.
 - .4 AC line voltage variation, -10 to +10% of nominal with full output.
 - .5 No side clearance shall be required for cooling.
 - .6 All power and control wiring shall be done from the bottom.
 - .7 All VFDs shall be plenum rated.
- .9 Quality Assurance
- .1 To ensure quality, the complete VFD shall be tested by the manufacturer. The VFD shall drive a motor connected to a dynamometer at full load and speed and shall be cycled during the automated test procedure.
- .10 VFD shall utilize a full wave rectifier to convert three-phase AC to a fixed DC voltage. Power factor shall remain above 0.98 regardless of speed or load. VFD’s employing power factor correction capacitors shall not be acceptable.
- .11 An internal line reactor (5% impedance) shall be provided to lower harmonic distortion of the power line and to increase the fundamental power factor.
- .12 The VFD shall be suitable for elevations to 1,000m above sea level without derating. Maximum operating ambient temperature rating shall not be greater than

- 40°C. VFD shall be suitable for operation in environments up to 95% non-condensing humidity.
- .13 The VFD shall be capable of displaying the following information in plain English via an alphanumeric display:
 - .1 Output Frequency
 - .2 Output Voltage
 - .3 Motor Current
 - .4 Kilowatts per hour
 - .5 Fault identification with text
 - .6 Percent torque
 - .7 Percent power
 - .8 RPM
 - .14 The VFD shall have the ability to automatically restart after an over-current, overvoltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
 - .15 Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
 - .16 Operator Control Panel (Keypad)
 - .1 Each VFD shall be equipped with a front mounted operator control panel (keypad) consisting of a backlit, alphanumeric, graphic display and a keypad with keys for Start/Stop, Local/Remote, Up/Down and Help. Two (2) Soft-keys will be provided which change functionality depending upon the position within the parameter hierarchy or state of panel.
 - .2 All parameter names, fault messages, warnings and other information shall be displayed in complete English words or Standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.
 - .3 The Display shall have contrast adjustment provisions to optimize viewing at any angle.
 - .4 The control panel shall provide a real time clock for time stamping events and fault conditions.
 - .5 The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same Drive or to another Drive.
 - .6 All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.
 - .7 The keypad shall be able to be installed or removed from the drive while it is powered, capable of remote mounting, and shall have its own non-volatile memory.
 - .17 Protective Functions:
 - .1 For each programmed warning and fault protection function, the Drive shall display a message in complete English words or Standard English abbreviations. The three (3) most recent fault messages along with time, current, speed, voltage, frequency and DI Status shall be stored in the

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- Drive's fault history. The last ten (10) fault names shall be stored in Drive memory.
- .2 The Drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.
 - .3 Output short circuit withstand rating and ground fault protection rated for 100,000 AIC shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.
 - .4 The Drive shall provide electronic motor overload protection qualified per UL508C.
 - .5 Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated or under voltage at 65% of min. rated and input phase loss.
 - .6 A power loss ride through feature will allow the Drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
- .18 Integrated Drive Disconnects
- .1 3-Phase: Individual integrated drive fused disconnects shall have exterior operators.
 - .2 Single-Phase: Individual integrated drive disconnects shall have exterior operators and external fusing.
- .19 Variable Speed System Sequence of Operation
- .1 The system shall consist of a pump logic controller with multi-pump parallel operation control, duty-standby pump selection, automatic alternation and automatic transfer to the standby pump upon pump/VFD failure.
 - .2 The pumping system shall start upon the closure of customer's contact when the pump logic controller Mode of Operation is in REMOTE.
 - .3 When the pump logic controller mode in LOCAL, the pumping system shall operate automatically. d. Each sensor/transmitter shall send a 4-20mA signal to the pump logic controller, indicative of process variable condition.
 - .4 When the set point is satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level.
 - .5 When the process variable exceeds the allowable drift from the set point for a set time the pump controller shall automatically start the next lag pump and continue in this fashion as necessary to satisfy system demand. To maintain system set point the controller will operate the pumps synchronously or sequentially to ensure maximum energy conservation.
 - .6
 - .7 As demand is satisfied, the controller shall automatically stop lag pumps as necessary to conserve energy.
 - .8 In the event of a pump failure or a VFD fault, the pump logic controller automatically initiates a timed sequence of operation to start the redundant pump/VFD set in the variable speed mode.
 - .9 In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/compare program. The redundant zone sensor/transmitters, if available, shall remain in the scan/compare program for control.

- .10 PUMP or VFD hard fault shall be flash continuously on the display on the operator interface of the pump logic controller until the fault has been corrected and the controller has been manually reset.
- .11 When the system is satisfied, the pump controller shall shut down the single running lead pump without the need of a flow sensor/switch or hydro-pneumatic tank and enter energy saving / no flow shutdown mode.

.2 MECHANICAL

- .1 Pump Station Frame and Piping
 - .1 Framing shall be designed and fabricated to provide structural support for all attached equipment, and provide anchor bolt support. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, off loading, installation, and operation.
 - .2 Piping shall be constructed from 304 stainless steel, schedule 10 or heavier pipe as required to maintain a 3 to 1 pressure safety factor (including 1/16" corrosion allowance).
- .2 Stainless steel vertical multi-stage Pumps:
 - .1 Compliant to ANSI/NSF-61 Annex G
 - .2 AISI 304 wetted components
 - .3 Impeller: AISI 304
 - .4 Diffuser: AISI 304
 - .5 Shaft: AISI 316 (sizes 1 – 22SV) • Duplex ASTM-A182 (sizes 33-92SV)
 - .6 External sleeve: AISI 304
 - .7 Pump body: AISI 304
 - .8 Seal housing: AISI 304
 - .9 Mechanical seal: all material options NSF/ANSI-61 compliant
- .3 Isolation Ball Valves
 - .1 Isolation ball valves shall be certified to NSF-61 for use with potable drinking water.
 - .2 Isolation ball valves shall be certified as low lead having wetted surface area with a weighted average lead content < 0.25%.
 - .3 Valves shall be rated for 600 psi WOG / 150 psi WSP for valves 1/4" to 2" and 400 psi WOG / 125 psi WSP for valves 2-1/2" to 4".
 - .4 Seats and stem packing shall be virgin PTFE. Stem shall be bottom loaded blowout proof design with fluorocarbon elastomer O-ring to prevent stem leaks.
 - .5 Valves shall be 2-piece full port design.
- .4 Isolation Grooved Butterfly Valves
 - .1 Valves shall be certified to NSF-61 for use with potable drinking water.
 - .2 Valve bodies shall be nylon coated ductile iron conforming to ASTM A536 with integral neck and ISO mounting top.
 - .3 The disc shall be encapsulated with Gr. E EPDM for cold and hot water services.
 - .4 Valves shall be rated for 300 psi CWP
- .5 Isolation Lug Style Butterfly Valve

- .1 Valve shall be certified to NSF-61 for use with potable drinking water.
- .2 Valve body shall be made of ASTM 536 ductile iron and will be coated with an FDA approved epoxy. Valve face to face dimensions shall comply with API 609 and MSS-SP-67.
- .3 Disc shall be made of ASTM A-351 stainless steel. Shaft shall be made of 316SS.
- .4 Bushing shall be made of a Teflon®-Darcon inner liner bonded to fiberglass-epoxy resin outer shell.
- .5 Seat shall be EPDM.
- .6 Valve shall be rated to 200 psi WOG.
- .6 Threaded Check Valves
 - .1 All valve metallic components shall be 316SS.
 - .2 Seat shall be Viton.
 - .3 Valve shall be rated for 400 psi WOG.
- .7 Wafer Check Valves
 - .1 The valve body shall be constructed of ASTM A126 Class B cast iron for Class 125/150 and Class 250/300 valves.
 - .2 The seat and disc shall be ASTM B584 Alloy C83600 cast bronze or ASTM B148 Alloy C95200 aluminum bronze.
 - .3 The compression spring shall be ASTM A313 Type 316 Stainless Steel with ground ends.
 - .4 Valve interiors and exteriors shall be coated with an NSF/ANSI-61 certified fusion bonded epoxy in accordance with AWWA C550.
 - .5 The exterior of the valve shall be coated with a universal alkyd primer.
 - .6 The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the nominal valve size.
 - .7 The operation of the valve shall not be affected by the position of installation. The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down.
 - .8 All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi.
 - .9 The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.
 - .10 The valve disc and seat shall have a seating surface finish of 16 micro-inch or better to ensure positive seating at all pressures. The leakage rate shall not exceed the allowable rate for metal-seated valves allowed by AWWA Standard C508 or 1 oz (30 ml) per hour per inch (mm) of valve diameter.
 - .11 The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Cv flow coefficients shall be equal to or greater than specified below and verified by an independent testing laboratory.

VALVE SIZE – MM	WAFER STYLE - Cv
50	43
65	88
80	130
100	228
125	350
150	520

- .12 The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure and seat tested at the valve CWP.
- .8 Sensor / Transmitters:
- .1 Pressure transducer shall be utilized for providing all pressure signals for the pump control logic. Pressure transducer shall be a solid-state bonded strain gage-type with an accuracy of $< \pm 0.5\%$ BFSL and constructed of 316 stainless steel. Transducer shall be rated for a pressure of 2,068 kPa and shall provide gauge pressure output, rather than an absolute. Pressure transducer constructed of plastic is not acceptable. Pressure transducer shall be 4-20mA analog type with 10-28 VDC supply range, shall utilize a Packard-type connector to prevent moisture intrusion, and include surge protection to protect against voltage spikes.
- .9 Flowmeter:
- .1 Provide a field mounted flow sensor transmitter as indicated on the plans. Unit shall transmit an isolated 4-20 mA dc signal indicative of process variable to the pump logic controller via standard two wire 24 VDC system. Unit shall consist of an insertion probe and separately mounted transmitter. The unit shall be accurate to within 1% of flow rate from 0.305 to 9.15 mps and shall withstand a static pressure of 1,379 kPa with negligible change in output.
- .10 Pressure Gauges:
- .1 Gauges shall be provided for the suction and discharge manifold.
- .2 Accuracy shall be $\pm 1.5\%$
- .3 Bourdon tube and connection shall be constructed of 316SS.
- .4 Case, bezel and internals shall be constructed of 316SS.
- .5 Gauge shall be filled with glycerin in order to dampen pulsation and vibration and to provide lubrication to the internal parts.
- .6 Gauge range shall be selected to cover the largest operating range for the specific conditions and pump selected.
- .11 Flange Bolts
- .1 Bolts shall be zinc plated and shall meet ASTM Grade A193 B7.
- .12 Paint
- .1 Standard finish coat shall be acrylic enamel to a thickness of no less than 3 mils.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install equipment in accordance with manufacturer's instructions.

The contractor shall align the pump and motor shafts to within the manufacturer's recommended tolerances prior to system start-up.

Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the controls contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

3.2 DEMONSTRATION/TRAINING

- .1 The system manufacturer's factory qualified representative shall be capable of providing optional start-up of the packaged pumping system. This start-up shall include verification of proper installation, system initiation, adjustment, and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the owner or owner's designated representative. This job site visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.

The system manufacturer's factory qualified representative shall be capable of providing on-site training for owner's personnel. This training shall fully cover maintenance and operation of all system components.

The system manufacturer must have an optional complete pressure booster system training program available for owner's personnel. The training sessions shall take place at the manufacturer's facility and cover all aspects of pressure booster system design, service and operation.

3.3 WARRANTY

- .1 The manufacturer shall warrant the water pumping system to be free of defects in material and workmanship for one year (12 months) from date of authorized start-up, not to exceed eighteen (18) months from date of manufacturer's invoice. Complete terms and conditions will be provided upon request.

The complete VFD shall be warranted by the manufacturer for a period of thirty (30) months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer and not a third party.

A written warranty statement shall be provided with the submittals.

The manufacturer shall offer an optional, extended warranty allowing the VFD warranty to be extended to up to 6 years.

3.4 START-UP SERVICE

- .1 Owner start up assistance will be provided by a manufacturer-qualified representative and will be limited to one (1) eight-hour (8) day for all VFDs, unless previously negotiated by the factory representative.

When discharge piping, electrical connections, and electrical inspection have been completed, the pump station representative shall be contacted for start up.

A minimum two-week notice shall be given to the manufacturer-qualified representative prior to scheduled start up date.

During start up, the complete pumping system shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration, or overheating, and shall demonstrate its general fitness for service.

All defects shall be corrected and adjustments shall be made to the pumping station for satisfactory operation. System problems or concerns will be corrected by the general contractor or site station staff, in conjunction with the appropriate factory qualified representative.

Testing shall be repeated until satisfactory results are obtained, as determined by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance, and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment, and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, and components.

3.3 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

- .1 Install manual air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.

- .3 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC COUPLINGS

- .1 General: Compatible with system, to suit pressure rating of system.
- .2 Locations: Where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: Isolating flanges.

3.6 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use gate valves at branch take-offs for isolating purposes except where otherwise
- .15 Check Valves:

- .1 Install silent check valves on discharge of pumps and elsewhere as indicated.
- .2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
 - .1 Provide Fab Pipe Inc. Ductile Iron Wall Sleeves (or approved equivalent), as indicated on mechanical drawing.
 - .1 Sleeves fabricated from ductile iron pipe conforming to ANSI/AWWA C151/A21.51, nominal wall thickness dimensions conforming to Class 53.
 - .2 Wall collars fabricated from ductile iron conforming to ASTM A536 to dimensions referenced in ANSI/AWWA C115/A21.15 Appendix C.
 - .3 Collars attached to sleeves using automatic arc welding as per ANSI/AWWA C115/A21.15 Appendix C and NAPF 700.
 - .4 Coatings and Linings:
 - .1 Ductile iron wall sleeves are to be finished with bituminous coating and lining per ANSI/AWWA C151.A21.51.
 - .2 Sizes: 6 mm minimum clearance between sleeve and non-insulated pipe or between sleeve and insulation.
 - .3 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
 - .2 Other floors: Terminate 25 mm (minimum) above finished floor.

3.8 PREPARATION FOR FIRESTOPPING

- .1 Non-insulated unheated pipes not subject to movement: No special preparation.
- .2 Non-insulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
- .3 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.9 FLUSHING OUT OF PIPING SYSTEMS

- .1 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative forty-eight (48) hours minimum prior to performance of pressure tests.
- .2 Pipework: Test as specified in relevant sections of Division 22 and 23.

- .3 Maintain specified test pressure without loss for four (4) hours minimum unless specified for longer period of time in relevant sections of Division 22 and 23.
- .4 Prior to tests, isolate equipment and other parts that are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Valves, gate and check.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
 - .1 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
 - .2 ASTM A126-95(2001), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .3 ASTM B62-93, Specification for Composition Bronze or Ounce Metal Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS SP-70-2006, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .2 MSS SP-71-2005, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
 - .3 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.
- .4 American National Standards Institute (ANSI) / National Sanitation Foundation (NSF).
 - .1 ANSI/NSF-2014, Drinking Water System Components – Health Effects.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit data for valves specified in this section.
- .3 Closeout Submittals:
 - .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIAL

- .1 Valves:
 - .1 Except for specialty valves, to be of single manufacturer.

-
- .2 All valve assemblies shall be certified to ANSI/NSF-61 for use with potable drinking water.
 - .2 Standard specifications:
 - .1 Gate valves: MSS SP-70.
 - .2 Check valves: MSS SP-71.
 - .3 Requirements common to valves, unless specified otherwise:
 - .1 Body, bonnet: cast iron to ASTM B209 Class B.
 - .2 Connections: flanged ends plain face with 2 mm raised face with serrated finish to ANSI B16.1.
 - .3 Inspection and pressure testing: to MSS SP-82.
 - .4 Bonnet gasket: non-asbestos.
 - .5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
 - .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
 - .7 Gland packing: non-asbestos.
 - .8 Handwheel: Die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
 - .9 Identification tag: with catalogue number, size, other pertinent data.
 - .4 All products to have CRN registration numbers.

2.2 GATE VALVES

- .1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze trim, solid wedge disc:
 - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly. Class 250.
 - .2 Disc: solid offset taper wedge, bronze to ASTM B62.
 - .3 Seat rings: renewable bronze to ASTM B62, screwed into body.
 - .4 Stem: bronze to ASTM B62.
 - .5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.
 - .6 Seat: Integral with body.
 - .7 Stem: wrought steel.
 - .8 Operator: Handwheel and chain manual gear – high installations
- .2 NPS 10 - 24, non rising stem, inside screw, bronze trim, solid wedge disc:
 - .1 Body and multiple-bolted bonnet: cast iron to ASTM A126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.
 - .2 Pressure ratings: Class 250
 - .3 Disc: solid offset taper wedge, with bronze rings to ASTM B62 rolled into cast iron disc, secured to stem.
 - .4 Seat rings: renewable bronze to ASTM B62 screwed into body.
 - .5 Stem: bronze to ASTM B62.

- .6 Disc: solid offset taper wedge, cast iron secured to stem.
- .7 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.
- .8 Stem: wrought steel.
- .9 Operator: Handwheel and manual chain gear for high installation.

2.3 UNDERWRITERS APPROVED GATE VALVE

- .1 NPS 2 1/2 - 14, OS&Y:
 - .1 Approvals: UL and FM approved for fire service.
 - .2 UL and FM Label: on valve yoke.
 - .3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC 262 (B).
 - .4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
 - .5 Packing gland: bronze.
 - .6 Stem: manganese bronze. Diameter to ULC C-262 (B).
 - .7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
 - .8 Bosses for bypass valve, drain: on NPS 4 and over.
 - .9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: cast iron with bronze disc rings.
 - .10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
 - .11 Pressure rating:
 - .1 NPS 2-1/2 - 12: 1.7 Mpa CWP.
 - .2 NPS 14-1.2: 1.2 MPa CWP.
 - .12 Operator: Handwheel.
 - .13 Bypass: complete with union and NPS gate globe valve as Section 23 05 22 - Valves - Bronze, paragraph.

2.4 VALVE OPERATORS

- .1 Install valve operators as follows:
 - .1 Handwheel: on valves except as specified.
 - .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in mechanical equipment rooms.

2.5 CHECK VALVES

- .1 Swing check valves, Class 250:
 - .1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Flanged ends: plain faced with smooth finish.
 - .1 Up to NPS 16: cast iron to ASTM A126 Class B.
 - .2 NPS 18 and over: cast iron to ASTM A126 Class C.
 - .2 Disc: rotating for extended life.
 - .1 Up to NPS 6: bronze to ASTM B 62.
 - .2 NPS 8 and over: bronze-faced cast iron.
 - .3 Seat rings: renewable bronze to ASTM B62 screwed into body.
 - .4 Hinge pin, bushings: renewable bronze to ASTM B62.
 - .5 Disc: A126 Class B, secured to stem, rotating for extended life.

- .6 Seat: cast iron, integral with body.
- .7 Hinge pin: exelloy; bushings: malleable iron.
- .8 Identification tag: fastened to cover.
- .9 Hinge: galvanized malleable iron.
- .2 Swing check valves, NPS 2 1/2 - 8 Class 250:
 - .1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.
 - .2 Flanged ends: 2 mm raised face with serrated finish.
 - .3 Rating: 250 psi steam; 500 psi CWP.
 - .4 Disc: rotating for extended life.
 - .1 Up to NPS 3: bronze to ASTM B61.
 - .2 NPS 4 - 8: Iron faced with ASTM B61 bronze.
 - .5 Seat rings: renewable bronze to ASTM B61, screwed into body.
 - .6 Hinge pin, bushings: renewable, bronze to ASTM B61.
 - .7 Hinge: galvanized malleable iron.
 - .8 Identification tag: fastened to cover.

2.6 SILENT CHECK VALVES

- .1 Construction:
 - .1 Body: malleable or ductile iron with integral seat.
 - .2 Pressure rating: class 125, WP = 860 kPa.
 - .3 Connections: grooved ends.
 - .4 Disc: bronze or stainless steel renewable rotating disc.
 - .5 Seat: renewable, EPDM.
 - .6 Stainless steel spring, heavy duty.

Part 3 Execution

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.

END OF SECTION

MECHANICAL IDENTIFICATION

PART 1 - GENERAL**1.1 References**

- .1 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.2 Samples

- .1 Submit samples in accordance with Section 010010.
- .2 Submit samples and lists in accordance with section 010010 of proposed wording for approval before engraving.

PART 2 - PRODUCTS**2.1 Manufacturers Nameplates**

- .1 Provide metal nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters.
- .2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 System Nameplates

- .1 Colour:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick, laminated plastic or white anodized aluminum, matte finish, square corners, letters accurately aligned and machine engraved into core.

MECHANICAL IDENTIFICATION

2.2 System Nameplates (cont'd)

.3 Sizes:

Size #	.1 Conform to following table:		
	Dimensions (mm x mm)	No. of Lines	Letter Height (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 200	1	8
6	20 x 100	2	5
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use average of 25 letters/numbers (maximum) per nameplate.

.3 Use size #6 for terminal cabinets and control panels.

.4 PMSS identification:

.1 General: use system of Main Identifier, Source Identifier, Destination Identifier.

.2 Equipment and Mechanical Rooms: Main Identifier: size #9; Source and Destination Identifiers: size #5.

.3 Elsewhere: Sizes as appropriate.

2.3 Piping

.1 General:

.1 To CAN/CGSB 24.3.

.2 Identify medium by lettered legend, classification by primary and secondary colours, direction of flow by arrows.

.2 Sizes:

.1 Legend: block capitals to following table:

Outside Dia. of Pipe or Insulation mm	Size of Letters mm
30	13
50	19
150	32
250	63
Over 250	88

MECHANICAL IDENTIFICATION

2.3 Piping (cont'd)

- .2 Primary colour bands:
 - .1 At valves and fittings: 500 mm long.
 - .2 Elsewhere: 1000 mm long.
- .3 Secondary colour bands: 50 mm wide, 75 mm in from one end of primary colour band.
- .4 Arrows:
 - .1 Outside diameter of pipe/insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .2 Outside diameter of pipe/insulation less than 75 mm: 100 mm long x 50 mm high.
 - .3 Use double headed arrows where flow is reversible.
- .3 Material:
 - .1 Paint: to CAN/CGSB-1.60.
 - .2 Legend markers, arrows and colour bands: pressure sensitive plastic coated cloth with protective overcoating and waterproof contact adhesive undercoating, suitable for 100% RH and continuous operating temperature of 150 □C and
dry, clean prepared surfaces. Wrap tape around pipe or pipe covering with ends overlapping 1 pipe diameter.
 - .3 Waterproof and heat resistant pressure sensitive plastic marker tags: for pipes and tubing 20 mm nominal and smaller.
- .4 Colours:
 - .1 Where not covered by table below, submit legend, primary and secondary classification colours to Engineer for approval.
- .5 Table:
 - .1 Pipe and valve identification.

Pipe Marker Legend	Valve Tag Legend Colour	Primary Colour	Secondary Colour
Fire protection water	F.P.W	Red	White

- .2 Legend and arrows:
 - .1 Black or white to contrast with primary colour.
 - .2 Fire protection: white on red background.

2.4 Ductwork

- .1 50 mm high black stencilled letters and directional flow arrows 150 mm long x 50 mm high.

2.5 Valves and Controllers

- .1 Brass tags with 12 mm stamped code lettering and numbers.
- .2 Furnish Engineer with six identification flow diagrams of approved size for each system. Include valve tag schedule, designating number, service, function and location of each tagged item and normal operating position of valves.

2.6 Controls Identification

- .1 Refer to Div. 13.

2.7 Language

- .1 Identification to be English and French.
- .2 Use one nameplate or label for both languages.

PART 3 - EXECUTION

3.1 General

- .1 Do identification work in accordance with CAN/CGSB-24.3 except where specified otherwise.
- .2 Provide ULC and/or CSA registration plates, as required by respective agency.
- .3 Identify systems and equipment to conform to PWGSC, PMSS.

3.2 Location of Nameplates

- .1 In conspicuous location to facilitate easy reading from operating floor and to properly identify equipment and/or system.
- .2 Provide stand-offs for nameplates on hot surfaces and insulated surfaces.
- .3 Do not insulate or paint over plates.

3.4 Ductwork

- .1 Stencil over final finish only.
- .2 Locations of ductwork identification:

MECHANICAL IDENTIFICATION

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, and tunnels so that at least one is clearly visible from any one viewpoint in operating areas or walking isles and not at more than 17 m intervals.
- .2 Adjacent to all changes in direction.
- .3 At least once in each small room through which ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of any separation such as walls, floors and partitions.
- .6 Where ductwork is concealed in duct chase, gallery or other confined space, at entry and leaving points and adjacent to each access opening.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled dampers. Where this is not possible, place identification as close to damper as possible, preferably on upstream side.
- .9 Legend to be easily and accurately readable from usual operating areas and all readily accessible points.
- .10 Plane of legend to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of colour or legends caused by dust and dirt and risk of physical damage.
- .11 Beside each access door.

3.5 Valves and Controllers

- .1 Secure tags with non-ferrous chains or closed "S" hooks for valves and operating controllers.
- .2 Install copies of flow diagram and valve schedule mounted in frame with non-glare glass where directed by Engineer. Provide one copy in each operating and maintenance instruction manual.
- .3 Consecutively number valves in system.

END OF SECTION

Part 1 General**1.1 SUMMARY****.1 Section Includes:**

- .1 General requirements that are common to NMS sections found in Division 26 – Electrical. This section supplements requirements of Division 1.

1.2 REFERENCES**.1 Canadian Standards Association (CSA International)**

- .1 CSA C22.1-06, Canadian Electrical Code
- .2 CSA C22.2
- .3 CAN/CSA-C22.3 No. 1-01, Overhead Systems.
- .4 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

- .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

1.3 DESIGN REQUIREMENTS**.1 Operating voltages: to CAN3-C235.****.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.**

- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English and French.**.4 Use one nameplate or label for each language.****1.4 SUBMITTALS****.1 Shop drawings:**

- .1 Submittals: in accordance with Section 01 00 10 – General Instructions.
- .2 Submit drawings for review, prior to ordering/purchasing any equipment.

.2 Quality Control:

- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

ELECTRICAL GENERAL REQUIREMENTS

- .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Engineer.
- .3 Manufacturer's Field Reports: submit to Engineer, manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in QUALITY ASSURANCE.
 - .4 Provide operation and maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.

1.5 QUALITY ASSURANCE

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 00 10 – General Instructions.

1.6 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 00 10 – General Instructions.

1.7 SYSTEM STARTUP

- .1 Instruct, Departmental Representative, Engineer and operating personnel in 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 aspects of its care and operation.

Part 2 Products**2.1 MATERIALS AND EQUIPMENT**

- .1 Material and equipment to be CSA certified. Where CSA certified equipment is not available, obtain special approval from authority having jurisdiction.
- .2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Divisions 21 and 23 and as shown on mechanical drawings.

2.3 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Engineer.
- .2 Decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicaid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.
 - .2 Sizes as follows:

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 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Engineer prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.10-07.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.8 FINISHES

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

Part 3 Execution**3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.

ELECTRICAL GENERAL REQUIREMENTS

- .1 Sleeves through concrete: schedule 40 steel pipe, 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.

3.4 LOCATION OF OUTLETS

- .1 Locate outlets as shown on 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.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 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.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.7 FIELD QUALITY CONTROL

- .1 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 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct and pay for the following tests:
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

ELECTRICAL GENERAL REQUIREMENTS

- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems: fire alarm system, communications.
- .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Engineer.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Report(s).
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

3.9 COORDINATION OF MECHANICAL AND ELECTRICAL WORK

- .1 Provide complete wiring and connections for all motors and other electrical equipment specified in Division 23 and 25.
- .2 Determine characteristics of equipment specified in Division 23 and 25. Provide proper starters, relays, coils, auxiliary contacts and interlocks.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65-93(R1999), Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

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 armoured cable, flexible conduit 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. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General**1.1 GENERAL**

- .1 In general, the wiring is not shown on the drawings for the different systems: the necessary wiring shall however be provided between all outlets and the panels and/or relays to which they are referred to on drawings. In some cases, the panel identification is not given for each circuit but is shown for particular area.

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 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90 - lead sheath over cable assembly and under armour.
- .3 Armour: interlocking type fabricated from aluminum strip.

Part 3 Execution**3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 All cables in suspended ceiling shall be properly strapped.
 - .3 Use armoured cables only in suspended ceilings when making final connection to equipment or in location(s) pre-approved by Engineer.

WIRES AND CABLES (0-1000 V)

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 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

Part 2 Products**2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 System and circuit, equipment, grounding conductors, bare, stranded copper, soft annealed, size as required.
- .3 Insulated grounding conductors: to section 26 05 21.
- .4 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.

Part 3 Execution**3.1 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.

- .6 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer 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**1.1 LOCATION OF CONDUITS**

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

Part 2 Products**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

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 5 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 90 degree bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 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**

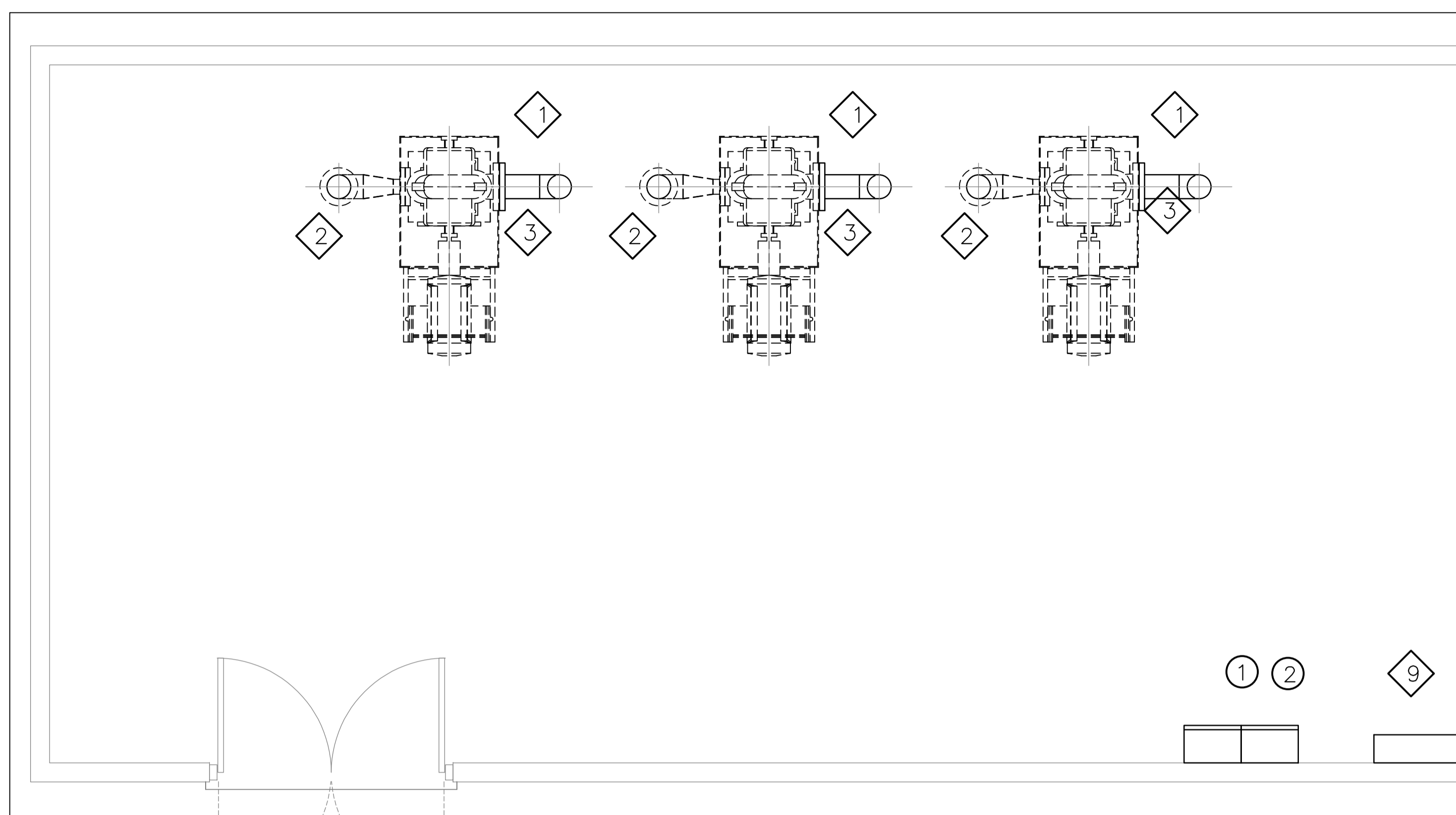
- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use rigid galvanized steel threaded conduit except where conduit is subject to mechanical injury.
- .4 Use electrical metallic tubing (EMT) for general use, except in cast concrete.
- .5 Use rigid pvc conduit underground.
- .6 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .9 Minimum conduit size for lighting and power circuits: 19 mm.
- .10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11 Mechanically bend steel conduit over 19 mm dia.
- .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13 Install fish cord in empty conduits.
- .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.

- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

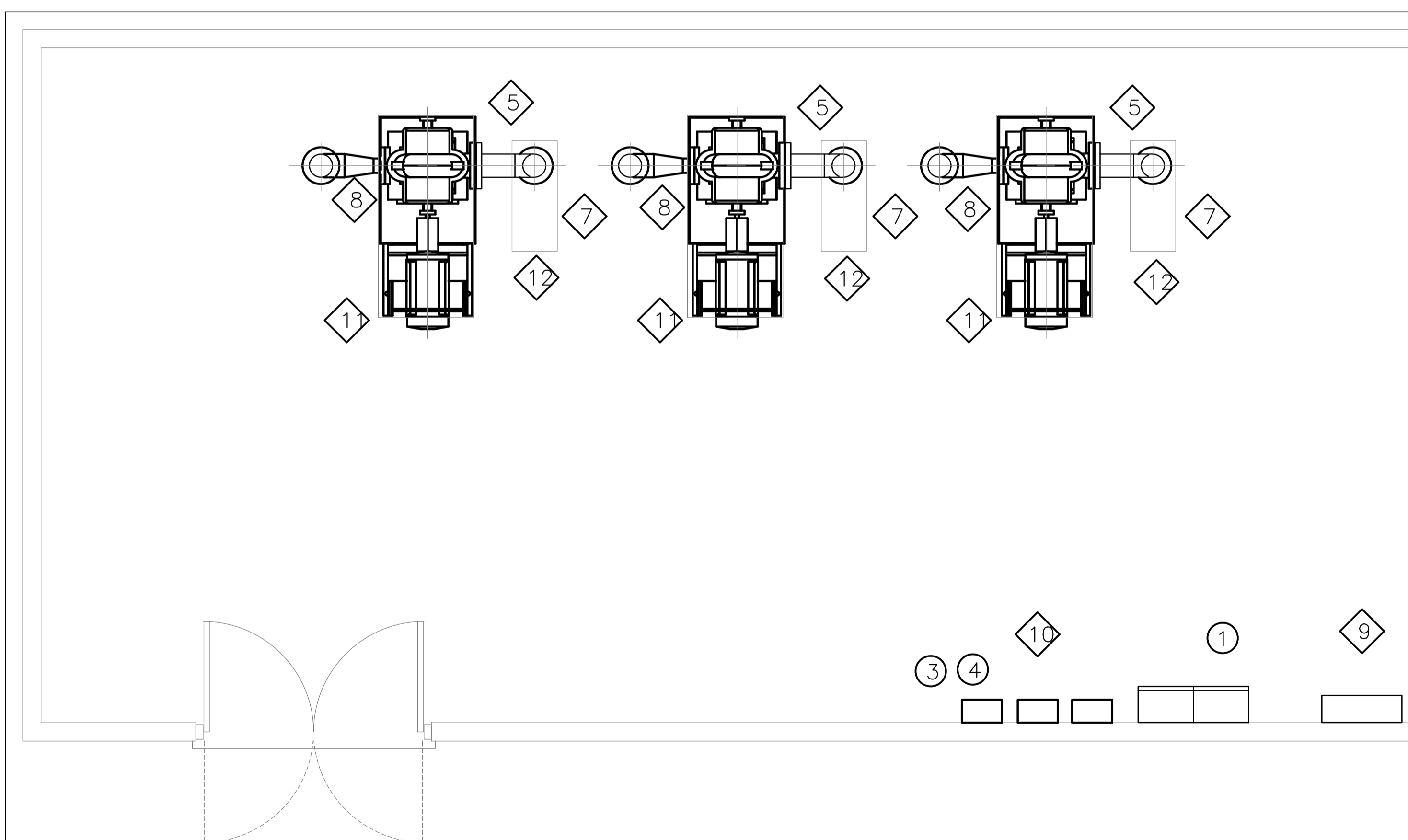
END OF SECTION



EXISTING PUMPS AND PIPING – DEMOLITION

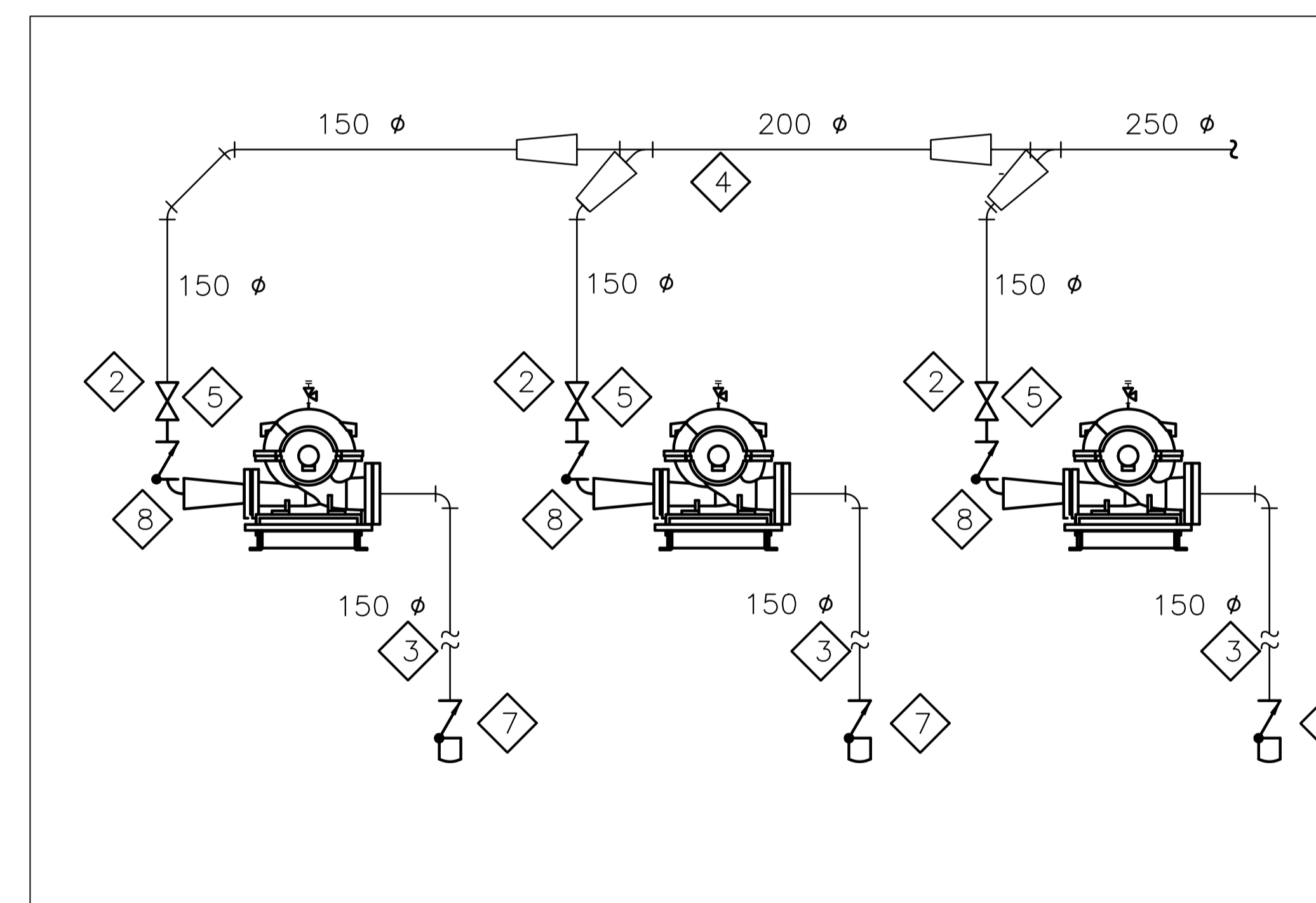
SCALE: N.T.S.

- MECHANICAL NOTES:**
- 1 EXISTING PUMPS TO BE DISCONNECTED AND REMOVED.
 - 2 REMOVE ISOLATION VALVE AND CHECK VALVE.
 - 3 REMOVE SUCTION PIPING, REMOVE EXISTING FOOT VALVE
 - 4 EXISTING HEADER TO STAY IN PLACE.
 - 5 INSTALL NEW PUMPS, ISOLATION VALVE AND CHECK VALVE
 - 6 CHECK VALVE AND FOOT VALVE IS TO BE SUPPLIED BY OWNER AND INSTALLED BY THIS CONTRACTOR.
 - 7 REPLACE FOOT VALVE AND RE-CONNECT SUCTION PIPING TO NEW PUMPS.
 - 8 PROVIDE NEW EXPANDER, FLANGE, 150° ELBOW, INSTALL ISOLATION VALVE AND CHECK VALVE, CONNECT TO EXISTING BRANCH CONNECTION.
 - 9 EXISTING CONTROLS PANEL.
 - 10 PROVIDE NEW VSD (3 IN TOTAL) FOR EACH PUMP, REUSE EXISTING CONTROLS, CONNECT TO VSD, PROVIDE NEW SYSTEM STATIC PRESSURE SENSOR TO PROVIDE INPUT TO VSD TO MAINTAIN STATIC PRESSURE SET POINT (586 KPa). EXISTING STATIC PRESSURE SENSOR TO CONTROL EXISTING PRESSURE RELIEF VALVE. SET POINTS TO BE FILED DECIDED WITH CLIENT.
 - 11 EXISTING HOUSEKEEPING PAD TO REMAIN
 - 12 MODIFY EXISTING CRATE TO SUITE NEW LOCATION OF SUCTION PIPE.
- ELECTRICAL NOTES:**
- 1 EXISTING MCC (THREE DISCONNECT SWITCHES C/W STARTER)
 - 2 REMOVE ELECTRICAL CONNECTION FROM EXISTING PUMP MOTORS, REMOVE WIRING UP TO MCC
 - 3 INSTALL NEW VSD'S (3 IN TOTAL), SUPPLIED BY MECHANICAL.
 - 4 PROVIDE NEW CONNECTION TO VSD AND FROM VSD TO NEW MOTOR. 4 #6 1 1/2" C



PUMP AND PIPING – NEW INSTALLATION

SCALE: N.T.S.



PIPING SCHEMATIC

SCALE: 1:50

PUMP SCHEDULE								
No.	SERVICE	MAKE/MODEL	CAPACITY (L/s)	Δ P (KPa)	RPM	VOLTAGE	HP	REMARKS
P-1-3	IRRIGATION	BELL & GOSSETT 4x6X14L HSC	25.24	590	1765	575	50	VSD CONTROLLED

TABLEAU DES POMPES								
REF	SERVICE	MARQUE/MODELE	DEBIT (L/s)	Δ P (KPa)	RPM	VOLTAGE	HP	REMARQUES
P-1-3	X	BELL & GOSSETT 4x6X14L HSC	25.24	590	1765	575	50	X

1		
0	ISSUED FOR TENDER	NOVEMBER, 2016
revision		date

A	A detail no. no. du détail	A
B	B location drawing no. no. de localisation	BC
C	C drawing no. no. du dessin	

project
**AGRICULTURE CANADA
 CENTRAL EXPERIMENTAL FARM
 SERVICE BUILDING No. 84
 PUMP REPLACEMENT**
 OTTAWA, ONTARIO

drawing
**DEMOLITION AND
 NEW INSTALLATIONS**

designed	L.M.K.	conçu
date	SEPT 2016	
drawn	L.M.K.	dessiné
date	SEPT 2016	
revised		révisé
approved	JRP	approuvé
date	SEPT 2016	
tender		soumission
Project Manager	Administrateur de projets	
project no.	CF160012	no. du projet

drawing no. M-1 OF 1
 no. du dessin