THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY 602-2006

NATURAL GAS ENGINE UPGRADES TO MACLEAN AND MCPHILLIPS PUMPING STATIONS

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 NATURAL GAS ENGINE UPGRADES TO MACLEAN AND MCPHILLIPS PUMPING STATIONS

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, August 23, 2007.

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

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

B3. SITE INVESTIGATION

B3.1 Further to C3.1, the Bidder is requested to attend a Site meeting starting at MacLean Pumping Station, 875 Lagimodiere Blvd., Winnipeg, from 9:00 a.m. to 11:00 a.m., August 15, 2007. Attendance is strongly recommended.

B3.2 Bidder should be familiar with both sites prior to submitting bid.

B3.3 The Bidder should not be entitled to rely on any information or interpretation received at the Site Meeting unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B3.4 Photos not permitted during site investigation.

B4. ENQUIRIES

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

B4.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

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

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

B4.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B4 unless that response or interpretation is provided by the Contract Administrator in writing.

B5. ADDENDA

B5.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

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

B6. SUBSTITUTES

B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

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

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:

(a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal in accordance with B6 or alternative;

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

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

(d) certify that, in the case of a request for approval as an approved equal in accordance with B6, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;

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

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an “approved equal in accordance with B6” or as an “approved alternative”, or may refuse to grant approval of the substitute.

B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.

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

B6.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B15.

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

B7. BID COMPONENTS

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

(a) Form A: Bid;

(b) Form B: Prices;

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

B7.2 Further to B7.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B6.

B7.3 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.

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

B7.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder’s Bid.

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

B7.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, may result in the Bid being determined to be non-responsive.

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

B7.8 Bids shall be submitted to:

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

B8. BID

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

B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

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

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

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

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

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

B8.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B8.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:

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

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

(c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;

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

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

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

B8.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.

B9. PRICES

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

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

B9.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.

B9.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.

B10. QUALIFICATION

B10.1 The Bidder shall:

(a) undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba; and

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

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

B10.2 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

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

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

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

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

(e) perform all engine control work at MacLean Pumping Station with a firm having a minimum of 7 years of continued experience in the field of industrial control systems. Site employee(s) shall have a minimum of 5 years of experience in the field of industrial controls systems, or a minimum of 2 years experience and be under the direct continuous supervision of an employee with a minimum of 5 years of experience;

(f) perform all engine rebuild work at McPhillips Pumping Station with the services of a firm having a minimum of 10 years of continued experience in repair of Waukesha stationary engines of same or equivalent size and power ratings to those at the McPhillips pumping station. On site supervisory staff shall have a minimum of 10 years of such experience, and other employees shall have a minimum of 5 years, of such experience, unless otherwise approved by the City;

B10.3 Further to B10.2(d), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

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

(b) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.).

B10.4 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B10.5 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B11. BID SECURITY

B11.1 The Bidder shall provide bid security in the form of:

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

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

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

B11.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

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

B11.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

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

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

B11.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

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

B12.1.1 Bidders or their representatives may attend.

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

B12.2 Following the submission deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B12.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract Amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B12.4 The Bidder is advised that any information contained in any Bid may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B13. IRREVOCABLE BID

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

B13.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

B14. WITHDRAWAL OF BIDS

B14.1 A Bidder may withdraw his Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B14.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B14.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B14.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

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

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

(c) if the notice has been given by any one of the persons specified in B14.1.3(b), declare the Bid withdrawn.

B14.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B13.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

B15. EVALUATION OF BIDS

B15.1 Award of the Contract shall be based on the following bid evaluation criteria:

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

(b) qualifications of the Bidder and Subcontractors; if any, pursuant to B10 (pass/fail);

(c) Total Bid Price;

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

B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

B15.3 Further to B15.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid, or in other information required to be submitted, that he is responsible and qualified.

B15.4 Further to B15.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.

B15.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.

B16. AWARD OF CONTRACT

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

B16.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

B16.2.1 Without limiting the generality of B16.2, the City will have no obligation to award a Contract where:

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

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

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

(d) only one Bid is received; or

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

B16.3 Subject to B16.2, where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid.

B16.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

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

C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

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

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of supply and replacement of two new natural gas engine drives and related systems at MacLean Pumping Station and a partial rebuild of two natural gas engine drives and three exhaust systems at McPhillips Pumping Station.

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

(a) At MacLean Pumping Station, upon City approval,

(i) supply and deliver two (2) standard emission natural gas engines and associated equipment required for direct connection to existing centrifugal municipal water pumps. Work shall be completed on Engine P26 prior to start of work on Engine P22;

(ii) Remove two existing engine drives and base plates (frames), associated fuel, cooling, combustion air and exhaust systems, asbestos removal and dispose of materials;

(iii) Demolish parts of and replace existing concrete foundation for the two engines;

(iv) Install the two new engines and associated control, fuel, cooling, combustion air and exhaust systems, and reconnect to pumps;

(v) Provide engine Manufacturer's representative to assist in the installation, testing and commissioning of the engine drives;

(vi) Provide all specified factory and field testing and commissioning including reporting.

(vii) Provide all specified training;

(viii) Provide complete submittal and operations and maintenance documentation with specific identification of equipment provided for this project;

(ix) Supply spare parts as identified.

(b) At McPhillips Pumping Station,

(i) Rebuild two existing natural gas engines at the McPhillips Pumping Station as specified herein;

(ii) Replace 3 exhaust systems, including asbestos removal.

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

(a) "**Installation Contractor and/or Installer**", means the General Contractor retained by the City, under a separate contract, to install the equipment supplied under this contract;

(b) **ANSI** means American National Standards Institute;

(c) **ASME** means American Society of Mechanical Engineers;

(d) **ASTM** means American Society for Testing and Materials;

(e) **AWWA** means American Water Works Association;

(f) **CSA** means Canadian Standards Association;

(g) **DAF** means Dissolved Air Flotation;

(h) **IEC** means International Electro-technical Commission;

(i) **ISO** means International Standards Organization;

(j) **NACE** means National Association of Corrosion Engineers;

(k) **NEMA** means National Electrical Manufacturer's Association;

(l) **NSF** means National Sanitation Foundation;

(m) **SAE** means Society of Automotive Engineers;

(n) **CEC** means Canadian Electrical Code;

(o) **LOX** means liquid oxygen;

(p) **Manufacturer** means the person, partnership or corporation responsible for the manufacture and fabrication of equipment provided to the City for the completion of the work;

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

(r) **IEEE** means Institute of Electrical and Electronics Engineers;

(s) **Furnish** means supply;

(t) **ISA** means the Instrumentation Systems and Automation Society;

(u) **AGMA** means American Gear Manufacturer's Association;

(v) **API** means American Petroleum Institute;

(w) **EEMAC** means Electrical and Electronic Manufacturer's Association of Canada;

(x) **VSD** means Variable Speed Drive;

(y) **VFD** means Variable Frequency Drive;

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

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

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

(cc) **Major Equipment** means all equipment for which shop drawing submittals are required as specified in Division 11, 16 and 17;

(dd) **Certified Shop Drawings** means Shop Drawings prepared by the Contractor after all required Shop Drawings have been "reviewed" or "reviewed as modified" in accordance with Section E6 of this Bid Opportunity and which incorporate all modifications to the Shop Drawings, comments and notations made by the Contract Administrator in the course of the review.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is UMA Engineering Ltd. represented by:

Claude Courchaine, P. Eng
Mechanical Engineer
UMA Engineering Ltd.
1479 Buffalo Place
Winnipeg, MB R3T 1L7

Telephone No. (204) 928-7415 or (204) 284-0580
Facsimile No. (204) 475-3646

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

D5. CONTRACTOR'S SUPERVISOR

D5.1 At the pre-construction meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D6. NOTICES

D6.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3, D6.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.

D6.3 All notices of appeal to the Chief Administrative Officer shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 949-1174

D6.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 947-9155

D7. FURNISHING OF DOCUMENTS

D7.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

SUBMISSIONS

D8. AUTHORITY TO CARRY ON BUSINESS

D8.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on

business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D9. SAFE WORK PLAN

D9.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D9.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

D10. INSURANCE

D10.1 The Contractor shall provide and maintain the following insurance coverage:

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

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

(c) all risks course of construction insurance in the amount of one hundred percent (100%) of the total Contract Price, written in the name of the Contractor and The City of Winnipeg, at all times during the performance of the Work and until the date of Total Performance.

D10.2 Deductibles shall be borne by the Contractor.

D10.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract.

D10.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

D11. PERFORMANCE SECURITY

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

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

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

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

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

D11.2 If the bid security provided in his Bid was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D12. SUBCONTRACTOR LIST

D12.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D13. DETAILED WORK SCHEDULE

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

D13.2 The detailed work schedule shall consist of the following:

(a) a critical path method (C.P.M.) schedule for the Work;

(b) a Gantt chart for the Work based on the C.P.M. schedule;

(c) a daily manpower schedule for the Work;

all acceptable to the Contract Administrator.

D13.3 Further to D13.2(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

D13.3.1 MacLean: show the following for each engine:

(i) Submittal of engine shop drawings;
(ii) Completion of engine removal and foundation replacement;
(iii) Delivery of engine and components;
(iv) Placement of engine and baseplate and connection to pump;
(v) Completion of fuel system and cooling system;
(vi) Completion of exhaust system and combustion air work;
(vii) Completion of electrical and controls work;
(viii) Field Test Completion;
(ix) Satisfactory Performance;
(x) Critical Stages;
(xi) Substantial Performance;
(xii) Total Performance.

D13.3.2 McPhillips: show the following for each engine:

(i) Replacement of cylinder heads and exhaust manifolds;
(ii) Replacement of specified number of liners and pistons;
(iii) Completion of exhaust system work;
(iv) Satisfactory Performance;
(v) Critical Stages;
(vi) Substantial Performance;

(vii) Total Performance.

D13.4 Further to D13.2(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

D13.5 Further to D13.2(c), the daily manpower schedule shall list the daily number of individuals on the Site for each trade.

D14. SECURITY CLEARANCE

D14.1 Each individual proposed to perform the following portions of the Work:

(a) any Work on private property;

(b) any Work within City facilities other than:

(i) an underground structure such as a manhole;

(ii) in areas and at times normally open to the public;

shall be required to obtain a Criminal Record Search Certificate from the police service having jurisdiction at his place of residence.

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

D14.3 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to property offences or crimes against another person, will not be permitted to perform any Work specified in D14.1.

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

D14.5 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a repeated criminal records search will not be permitted to continue to perform any Work specified in D14.1.

SCHEDULE OF WORK

D15. COMMENCEMENT

D15.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D15.2 The Contractor shall not commence the Work on the Site before receipt of approval from the City or the Contract Administrator.

D15.3 The Contractor shall not commence any Work on the Site until:

(a) the Contract Administrator has confirmed receipt and approval of:

(i) evidence of authority to carry on business specified in D8;

(ii) evidence of the workers compensation coverage specified in C6.15;

(iii) the Safe Work Plan specified in D9;

(iv) evidence of the insurance specified in D10;

(v) the performance security specified in D11;

(vi) the Subcontractor list specified in D12;

(vii) the detailed work schedule specified in D13; and

(viii) the security clearances specified in D14.

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

D15.4 The Contractor shall commence work within 7 Calendar Days of Award of Contract.

D16. CRITICAL STAGES

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

MacLean Engines:

D16.1.1 MacLean Engine Shop Drawings:

(a) Acceptable Shop Drawings for all Major Equipment shall be completed within 60 Calendar Days of Award of Contract. Shop Drawing completion shall not be achieved until drawings are reviewed by the Contract Administrator;

(b) The Contract Administrator will endeavour to review Shop Drawings within fifteen (15) Calendar Days upon their submission. If review is not made within that time period, Contract dates provided in accordance with D13 will be extended by an equivalent number of Calendar Days;

(c) All Shop Drawings submitted pursuant to D13 shall be provided in a single submission.

D16.1.2 MacLean Engine Delivery:

(a) Delivery of Goods (new engines). The detailed delivery schedule will be based on the City's requirements and will be coordinated by the Contract Administrator, and included in the Detailed Work Schedule. The Goods shall be supplied in accordance with this schedule and delivery of the engines shall be as soon as possible, but within 24 months of Award of Contract;

(b) Delivery of the Goods shall be considered complete upon the issuance of Form 100: Certificate of Equipment Delivery and Form 101: Certificate of Instruction. A separate form shall be provided for each major component. These forms will be provided with the Contract Documents.

D16.1.3 MacLean Satisfactory Performance and Training

(a) Satisfactory Performance of the first engine shall be completed within 8 weeks of receipt of engine at MACLEAN PUMPING STATION;

(b) Satisfactory Performance of the second engine shall be completed within 6 weeks of achieving Satisfactory Performance of the first engine;

(c) Satisfactory Performance shall be considered complete upon the issuance of Form 102: Certificate of Satisfactory Installation. A single form is required for each engine and a separate form for the entire system;

(d) Training shall begin no earlier than upon commissioning of the first engine installation and shall be completed on or before achieving Total Performance of the first engine;

(e) The Contract Administrator will coordinate the training to coincide with the project commissioning schedule and will provide the Contractor a minimum of thirty (30) Calendar Days written notification of the acceptable date for the start of training;

(f) During the performance verification and training period the engine Manufacturer shall provide qualified representation on site as required to assist the Contractor in achieving and demonstrating satisfactory performance of the Goods supplied under this Contract.

D16.1.4 MacLean Total Performance for each engine.

(a) Total Performance of the each engine shall be completed within 8 weeks of Satisfactory Performance of that engine.

McPhillips Engine Rebuild and Exhaust Systems

D16.1.5 McPhillips engine rebuild and exhaust system work completion dates (Satisfactory Performance) are based on the work outlined in this specification and may be adjusted pending extra work.

(a) Rebuild and exhaust work on the first engine shall be completed within 4 weeks of the date specified for commencement of this work by the City and not more than 6 months after Award of Contract;

(b) Rebuild and exhaust work of the second engine shall be completed within 4 weeks of the date specified for commencement of this work by the City and not more than 9 months after Award of Contract. This work shall not begin until Total Performance of the first engine has been achieved;

(c) Exhaust work on the third engine shall be completed within 4 weeks of the date specified for commencement of this work by the City and not more than 12 months after Award of Contract. This work shall not begin until Total Performance of the second engine has been achieved.

D16.1.6 Satisfactory Performance shall be considered complete upon the issuance of Form 103: Certificate of Satisfactory Performance. A single form is required for each engine.

D16.1.7 Total Performance shall be considered complete upon the issuance of Form 105: Certificate of Total Performance. A single form is required for each engine.

D17. SUBSTANTIAL PERFORMANCE

D17.1 The Contractor shall achieve Substantial Performance as per the detailed work schedule approved by the Contract Administrator.

D17.2 Substantial Performance shall be attained when all of the following occurs:

(a) The two MacLean engines are operational and driving the pumps to provide the potable water flow normally achieved by the pumps;

(b) The two McPhillips engines are rebuilt and driving the pumps to provide the potable water flow normally achieved by the pumps;

(c) The three McPhillips exhaust systems have been replaced, allowing the engines to operate.

D17.3 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D17.4 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.

D18. TOTAL PERFORMANCE

D18.1 The Contractor shall achieve Total Performance as per the detailed work schedule approved by the Contract Administrator.

D18.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the

Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

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

D19. LIQUIDATED DAMAGES

D19.1 If the Contractor fails to achieve Total Performance in accordance with the Contract by the day fixed herein for Total Performance, the Contractor shall pay the City five thousand dollars ($5,000) per for each and every following the day fixed herein for Total Performance during which such failure continues.

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

D19.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D20. SCHEDULED MAINTENANCE

D20.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) MacLean Pumping Station engines: 500 hour service as specified in section E;

(b) McPhillips Pumping Station engines: 500 hour service as specified in section E;

(c) MacLean Pumping Station engines: final warranty inspection as specified in section E.

D20.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

CONTROL OF WORK

D21. JOB MEETINGS

D21.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D21.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D22. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D22.1 Further to C6.24, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

MEASUREMENT AND PAYMENT

D23. PAYMENT

D23.1 Further to C12, effective January 1, 2007 the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

D24. PAYMENT SCHEDULE

D24.1 Further to C12, payment shall be in accordance with the following payment schedule:

D24.1.1 The percentage amounts for MACLEAN PUMPING STATION are based on the total Contract and engine purchase costs.

D24.1.2 McPhillips

Waukesha Engines

(a) 95% for each engine upon issuance of Form 105 – Certificate of Total Performance for each engine. Each engine will be treated separately;

(b) 5% upon completion of 500 hour service for first engine;

(c) 5% upon completion of 500 hour service for second engine.

Caterpillar Engines

(d) 100% upon completion of exhaust system replacement.

D24.1.3 MacLean

(a) 1 % upon issuance of Certified Shop Drawings for the engine Manufacturer supplied items for both engines;

(b) 25% upon the issuance of Form 100: Certificate of Equipment Delivery and Form 101: Certificate of Instruction for first engine;

(c) 25% upon the issuance of Form 100: Certificate of Equipment Delivery and Form 101: Certificate of Instruction for second engine;

(d) 5% upon issuance of Form 102: Certificate of Satisfactory Installation for first engine;

(e) 5% upon issuance of Form 102: Certificate of Satisfactory Installation for second engine;

(f) 10% upon the issuance of Form 103: Certificate of Equipment Satisfactory Performance for first engine, and upon the completion of training of City staff and issuance of Form T1: Certificate of Satisfactory Training;

(g) 10% upon the issuance of Form 103: Certificate of Equipment Satisfactory Performance for second engine;

(h) 5% upon receipt of equipment manuals for both engines by the Contract Administrator;

(i) 12% upon the issuance of Form 105 – Certificate of Total Performance;

(j) 1% upon completion of 500 hour service for first engine;

(k) 1% upon completion of 500 hour service for second engine.

WARRANTY

D25. WARRANTY

D25.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire one (1) year thereafter unless extended pursuant to C13.2.1 or C13.2.2, or by purchase of extended warranty, in which case it shall expire when provided for thereunder.

FORM H1: PERFORMANCE BOND
(See D11)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

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

_____

_____ dollars ($_____.____)

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

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

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 602-2006.

NATURAL GAS ENGINE UPGRADES TO MACLEAN AND MCPHILLIPS PUMPING STATIONS

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

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

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

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

_____
(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 602-2006

NATURAL GAS ENGINE UPGRADES TO MACLEAN AND MCPHILLIPS PUMPING STATIONS

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

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

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

_____

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

_____
(Address)

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

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

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

_____ .
(Date)

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

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

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

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST

(See D12)

NATURAL GAS ENGINE UPGRADES TO MACLEAN AND MCPHILIPS PUMPING STATIONS

Name	Address

PART E - SPECIFICATIONS

GENERAL

E1. SPECIFICATIONS

E1.1 These Specifications shall apply to the Work.

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

E1.2.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

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

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

E1.3 The following are applicable to the Work:

Specification No.	Specification Title
N/A	TABLE OF CONTENTS
02 41 23	SELECTIVE SITE DEMOLITION
02 61 33	HAZARDOUS MATERIALS
02 82 12	ASBESTOS ABATEMENT – MAXIMUM PRECAUTIONS
03 05 10	CAST-IN-PLACE CONCRETE– SHORT FORM
05 12 23	STRUCTURAL STEEL FOR BUILDINGS
05 50 00	METAL FABRICATIONS
07 62 00	SHEET METAL FLASHING AND TRIM
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING
09 30 13	CERAMIC TILING
21 07 20	THERMAL INSULATION FOR PIPING
23 05 05	INSTALLATION OF PIPEWORK
23 05 17	PIPE WELDING
23 05 29	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 05 54	MECHANICAL IDENTIFICATION
23 08 01	PERFORMANCE VERIFICATION OF MECHANICAL PIPING SYSTEMS
23 08 02	CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS
23 11 23	FACILITY NATURAL GAS PIPING
23 31 14	METAL DUCTS – LOW PRESSURE TO 500 PA
23 33 00	AIR DUCT ACCESSORIES
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL
26 05 20	WIRE AND BOX CONNECTORS
26 05 21	WIRES AND CABLES (0-1000V)

26 05 34 CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

Drawing No.	Drawing Name/Title
N/A	Title Sheet and Drawing List
1-0630A-D-S0001 Sheet 001	Engine P22 and P26 Concrete Base
1-0630A-D-M0001 Sheet 001	Mechanical – General Notes and Legend
1-0630A-D-M0002 Sheet 001	Mechanical – Demolition Pump/Engine Level Floor Plan.
1-0630A-D-M0003 Sheet 001	Mechanical – Demolition Natural Gas Engine P-22 - Sections.
1-0630A-D-M0004 Sheet 001	Mechanical – Demolition Natural Gas Engine P-26 - Sections
1-0640A-D-M0005 Sheet 001	Mechanical – Demolition/New Construction Pump/Engine Level Floor Plan.
1-0640A-D-M0006 Sheet 001	Mechanical – P1, P3 & P5 Engine Exhaust Details
1-0630A-D-M0007 Sheet 001	Mechanical – New Construction Pump/Engine Level Floor Plan.
1-0630A-D-M0008 Sheet 001	Mechanical – New Construction Engine P-22 Replacement - Sections
1-0630A-D-M0009 Sheet 001	Mechanical – New Construction Engine P-26 Replacement - Sections
1-0630A-D-M0010 Sheet 001	Mechanical – New Construction Engine P-22 & P-26 Exhaust Details
1-0630A-D-M0011 Sheet 001	Mechanical – New Construction Engine P-22 & P-26 Pipe Support Details
1-0630A-D-E0001 Sheet 001	Electrical – Demolition Pump/Engine Level Floor Plan
1-0630A-D-E0002 Sheet 001	Electrical – New Construction Pump/Engine Level Floor Plan
1-0630A-D-A0001 Sheet 001	Process and Instrumentation Diagrams - Legend and Details
1-0630A-D-A0002 Sheet 001	Process and Instrumentation Diagrams - Legend and Details
1-0630A-D-A0003 Sheet 001	Process and Instrumentation Diagrams - Legend and Details
1-0630A-D-A0004 Sheet 001	Instrumentation – Loop Diagrams – Natural Gas Engine P-22
1-0630A-D-A0005 Sheet 001	Instrumentation – Loop Diagrams – Natural Gas Engine P-26
1-0630M-G-A0006 Sheet 001	Process and Instrumentation Diagrams – Pump No. 22
1-0630M-G-A0010 Sheet 001	Process and Instrumentation Diagrams – Pump No. 26

GENERAL REQUIREMENTS

E2. SITE USE AND CLEANLINESS REQUIREMENTS

E2.1 Office and Personnel Facilities

E2.1.1 The Contractor shall not have or grant to their employees any access to existing pumping station personnel facilities.

E2.1.2 The Contractor shall supply office and personnel facilities meeting the following requirements for both the MacLean and McPhillips Pumping Station works:

(a) A field office shall be located near the pumping station, located as directed by the Contract Administrator;

(b) The building shall have a minimum floor area of 20 square metres, with window area of 3 square metres and a door entrance with suitable lock satisfactory to the Contract Administrator;

(c) The building shall be suitable for all-weather use. It shall be capable of maintaining a temperature range between 16^{o}C to 25^{o}C;

(d) The building shall be supplied with adequate lighting and 120 Volt power supply (connection may be made to City outlet if suitable and approved by the Contract Administrator);

(e) The building shall include a source of potable water, either by connection to approved source or by use of bottled water and dispenser;

(f) The building shall be furnished with one desk, one meeting table, one filing cabinet and six chairs, all satisfactory to the Contract Administrator;

(g) A separate toilet with door lock and hand washing system shall be supplied for all staff;

(h) Food garbage shall be removed daily;

(i) The field office shall be cleaned weekly immediately prior to the Job Site Meetings to the satisfaction of the Contract Administrator;

(j) The provision of the field office with the aforementioned furnishings and equipment shall also include maintenance and removal of the field office, operating costs and any service installation costs.

E2.2 Work Site Cleanliness

E2.2.1 Continued cleanliness must be maintained in the building throughout the works.

E2.2.2 Foods and beverages other than water shall not be permitted to be stored or consumed in the building, unless specifically approved by the City.

E2.2.3 Work Enclosure:

(a) All concrete demolition and other dust creating works shall be contained within a sealed enclosure;

(b) The enclosure shall be maintained in tidy condition, and inspected daily prior to commencement of work. Any damages shall be repaired immediately upon discovery;

(c) The enclosure shall be mechanically exhausted directly to the outdoors by use of a mechanical ventilator, to provide a minimum of 10 air changes per hour when occupied;

(d) The exhaust system shall maintain the enclosure negative with respect to the building. There shall be a positive airflow into the enclosure, at a minimum of 50 feet per minute, through any penetrations or other openings in the enclosure;

(e) The Contractor shall be responsible for all aspects of the design of the enclosure and shall submit a shop drawing, for approval by the City, indicating the enclosure location, layout, structure and construction and ventilation.

E2.2.4 Work Area Cleanliness

(a) For cleaning purposes, the work area shall include all areas within any work enclosure, and the areas outside of the enclosure between east and west building walls up to approximately 25 feet from either extremity of the work area, or as limited by the building walls;

(b) All demolition and construction debris shall be removed to the outside of the building, on a daily basis, prior to departure of the last Contractor's personnel. This debris shall be placed in suitable bins provided by the Contractor;

(c) The area inside the enclosure shall be kept neat and tidy;

(d) The work area outside the enclosure shall be verified daily and any accumulation of construction dust on building equipment and piping be removed as required by wiping or vacuuming;

(e) The floor in the work area around the enclosure shall be washed on a daily basis;

(f) Upon removal of the enclosure, and during remaining works, the floor in the entire;

(g) Work area shall be swept and washed on a daily basis;

(h) At completion of works, the Contractor shall provide a general cleaning of the work area and the building, wiping or vacuuming all surfaces where construction dust has accumulated, an washing floor areas as required.

E3. BACKGROUND

E3.1.1 The City of Winnipeg operates three municipal water pumping stations. One station, Hurst, uses electric driven pumps only. At the other two stations, McPhillips and MacLean, both natural gas driven and electric driven pumps are used. The 5 natural gas driven pumps are normally operated as a backup to the electrical driven pumps. Thus, one of these 5 natural gas driven pumps, within the water distribution system, is normally operated Monday to Friday, 6 AM to 11 PM to protect against loss of electrical power and all pumping capacity. Natural gas pumps are also run during periods of inclement weather where the electrical supply to the stations may be threatened. A second natural gas pump may be operated at any time in conjunction with the first pump.

E3.1.2 The MacLean Pumping Station has two natural gas engine driven pumps, Pumps #22 and #26. These engines are Waukesha VLRO naturally aspirated units that were installed in 1962. These engines are to be replaced. The existing pumps are to be reused.

E3.1.3 The two Waukesha engines are direct coupled to DeLaval centrifugal pumps. Pneumatic actuators are used to engage Twin Disc clutches (Model EH224 P00, Serial #s 108361 and 108360 for pumps 22 and 26 respectively) used to transfer the power from the engines to the pump. A coupling is used to connect the clutch output shaft to the pump shaft.

E3.1.4 The pumps are operated at variable speeds to maintain a set pumping station discharge pressure. At MacLean, the normal range of pump speed is between 1000 and 1150 RPM. The maximum rated speed of all pumps is 1150 RPM.

E3.1.5 There is an actuated discharge valve on the outlet of each pump. The discharge valve is a two position type: open and closed. The valves are normally closed when the pump is off. The actuator takes approximately 2 to 3 minutes to fully open the valve from the closed position.

E3.1.6 The normal method of engine start up / pump activation is:

(a) Pre-lube pump runs on an adjustable on/off cycle when the engine is not running. Engine start signal results in an immediate start-up of the engine and oil lube pump;

(b) Engine started at idle speed (nominal 700 RPM) with clutch disengaged and discharge valve closed;

(c) After a set warm up period, the engine speed is increased to 1000 RPM (at MacLean) and the clutch is engaged with the discharge valve closed;

(d) After the discharge pressure reaches set point, the discharge valve is enabled to open and the pump speed can be adjusted to suit the station requirements.

E3.1.7 The normal method of shutting an engine down and pump down is:

(a) Pump speed reduced to minimum of 1000 RPM (at MacLean);

(b) Discharge valve enabled to shut;

(c) On indication of limit switch that the discharge valve is fully closed, the clutch is disengaged;

(d) Engine speed is reduced to idle and maintained at idle for a set period of time as recommended by the Manufacturer for the worst conditions;

(e) The engine is shut down;

(f) Note: the shutdown procedure can be interrupted at any time and the engine put back into service.

E4. APPLICABLE CODES AND STANDARDS

E4.1.1 International Standards Organization (ISO) 3046-1:2002 Reciprocating Internal Combustion Engines.

E4.1.2 Canadian Standards Association (CSA) Natural gas and Propane Installation Code, B149.1-05.

E4.1.3 CSA Code for the Field Approval of Fuel Related Components on Appliances and Equipment, B149.3-00 or latest edition.

E4.1.4 CSA Canadian Electrical Code, C22.1-06.

E4.1.5 CSA Boiler, Pressure Vessel, and Pressure Piping Code CSA B51-03

E4.1.6 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, ASME B31 Section VIII

E4.1.7 ASME Chemical Plant and Petroleum Refinery Piping, B31.3-2004.

E5. AVAILABLE INFORMATION

E5.1.1 The following available information is provided with the Bid Opportunity in the Appendices.

(a) MacLean pump curve (Appendix A);

(b) MacLean pump construction data (Appendix B);

(c) Twin Disc clutch information (SP-321P) (Appendix C);

(d) Existing base frame drawing (Appendix D);

(e) Site photos - posted with the City of Winnipeg Bid Opportunity documents;

(f) McPhillips Engine Inspection Reports (Appendix E);

(g) The following drawings of the existing installations are included for reference only (Appendix F):

Instrument Loop Diagrams LCP 22 Gas Pump Engine 22;

D-2552	D-2553	D-2554
D-2555	D-2556	D-2557
D-2558	D-2559	D-2560
D-2561	D-2562	D-2563
D-2564	D-2565	D-2566
D-2567	D-2568	D-2627

Instrument Loop Diagrams LCP 26 Gas Pump Engine 26;

D-2620	D-2621	D-2622
D-2623	D-2624	D-2625
D-2626	D-2628	D-2629
D-2630	D-2631	D-2632
D-2633	D-2634	D-2635
D-2636	D-2637	D-2638

E5.2 Design Conditions

E5.2.1 The design conditions are:

Altitude:	229 m ASL (745 ft.)
Pump Room Temperature (max.)	30ºC
Outside Temperature Range	-40 to 40ºC
Engine Jacket Water/Ethylene Glycol	50/50%
Fuel Type	Natural Gas
Fuel Pressure (gas)	35kPa (5psi) (supply pressure from local gas company)
Electrical Area Classification:	Unclassified

The typical natural gas characteristics as provided for August 2005 are listed below:

Parameters	Average	Maximum	Minimum
BTU-Dry (BTU/ft.^{3})	1005.10	1010.1	1002.3
MJ/m^3	37.434	37.620	37.330
Density	0.5791	0.5829	0.5766
N_2	1.9278	2.0084	1.8550
CO_2	0.6045	0.6437	0.5585
Methane	95.5313	95.8816	95.0241
Ethane	1.6590	1.9489	1.4477
Propane	0.1853	0.3007	0.1205
I-But	0.0207	0.0446	0.0104
N-But	0.0180	0.0365	0.0098
I-Pent	0.0036	0.0082	0.0015
N-Pent	0.0055	0.0166	0.0026
C_{6+}	0.0000	0.0000	0.0000
He	0.0400	0.0400	0.0400

E6. SUBMITTAL DATA

E6.1 Details of engine Manufacturer supplied components and technical services, including the engines, are to be provided.

E6.2 Unless otherwise specified or requested, provide submittals including shop drawings as per City of Winnipeg CW 1110 - General Instructions (available from the City's Standard Construction Specifications web site) and as stated below.

E6.3 Upon City approval of engine selection, the following submittals shall be provided:

E6.3.1 Shop Drawings for all equipment to be supplied shall be submitted to the Contract Administrator within 60 Calendar Days of award of contract for review prior to the engine Manufacturer manufacturing the equipment.

E6.3.2 Provide six paper copies of shop drawings, minimum size 280 mm x 430 mm (11" x 17") and 1 electronic (.pdf) copy to the Contract Administrator.

E6.3.3 Anchor bolt details and templates shall be submitted.

E6.3.4 Torsional Analysis report shall be submitted.

E6.3.5 Operating and Maintenance Data

E6.3.6 Contractor shall provide four original sets of manuals (in English) for each type of equipment. These shall be submitted to the Contract Administrator for review. Engine Manufacturer shall provide these manuals sixty (60) Calendar Days in advance before commencement of equipment operation.

E6.3.7 Enclose contents in a three ring, hard-covered, plastic-jacketed binder with full cover and spine insert. Organize contents into applicable sections of work using labelled and tabbed dividers, parallel to Specifications breakdown.

E6.3.8 In addition to information called for in the Specifications, include the following;

E6.3.9 Title sheet, labelled "Operation and Maintenance Instructions for (Make and Model of Engine)". Include project name, supplier and date, Bid Opportunity # 703-2005, and the City of Winnipeg Project # W595.

E6.3.10 Local and 24 hour emergency technical support and service contact telephone number(s).

E6.3.11 Table of contents.

E6.3.12 Reviewed shop drawings of all equipment.

E6.3.13 Certified factory test results in accordance with this Specification.

E6.3.14 Full description of all systems, operation and control.

E6.3.15 Names, addresses and telephone numbers of all major sub-Contractors and suppliers.

E6.3.16 Detailed Specifications and Operating and Maintenance instructions for all items of equipment provided including a preventative maintenance program.

E6.3.17 Itemized list of spare parts recommended for five years service, identify high priority components of which failure will render the equipment supplied inoperative. Any special tools or other ancillary items necessary for commissioning and/or proper operation and maintenance shall also be listed.

E6.3.18 Illustrated parts books and list of all assemblies, sub-assemblies and components.

E6.3.19 Test procedures for all electronic and electrical circuits.

E6.3.20 Troubleshooting guide covering the complete engine and ancillary devices, showing description of trouble, probable cause and suggested remedial action.

E6.3.21 Field test results (to be provided upon test completion).

E6.3.22 A Digital Video Disk (DVD) of training session held in Winnipeg (after completion of training). The DVD shall be playable on a standard NTSC DVD player.

E6.3.23 Engine Manufacturer shall modify and update the manual as required by the Contract Administrator. When accepted, five (5) additional copies shall be provided by the engine Manufacturer to the Contract Administrator thirty (30) days in advance of equipment start-up.

E6.3.24 The Contract shall not be considered complete until the above manuals have been completed and submitted, to the satisfaction of the Contract Administrator.

E7. GOODS – MACLEAN PUMPING STATION

E7.1 Pump Drive Package

E7.1.1 The pump driver package supplied by the engine Manufacturer is to consist of an engine, clutch, drive coupling, engine cooling system, fuel gas train, engine silencers, flexible connectors for all systems, expansion joint/flexible connector for exhaust, monolithic steel engine and pump base, controls and indication, crankcase emission filtering system and other features as specified.

E7.1.2 The engine Manufacturer is to be responsible for the assembly of the engine and all attached equipment including the clutch. (The Contractor will couple the unit to the existing pump).

E7.2 Engine

E7.2.1 The pump driver is to be a standard emission natural gas fired, stationary, industrial engine designed for a maximum continuous speed of 1200 RPM. The engine is to be naturally aspirated or turbo charged. The engine is to be liquid cooled, four stroke design, four valve heads, and either vertical in-line or V-form configuration. Engine shaft rotation is to match the pump rotation. The engine is to be provided as a complete package ready for the connection of power, fuel and other site services.

E7.2.2 The engine shall match pump rating in accordance with the ISO 3046-1 definition for ISO Standard Power Continuous Rating where the rated speed indicates the highest speed and load that can be applied 7 days per week, 365 days per year, except for normal maintenance at ISO standard ambient reference conditions.

E7.2.3 Minimum engine power requirement at speed shown is:

PUMP	Location	BHP @ 1150 RPM	BHP @ 1000 RPM
#22	MacLean	640	420
#26	MacLean	640	420

E7.2.4 MacLean operating RPM range: 1000-1150

E7.2.5 Acceptable engine suppliers are Caterpillar or Waukesha and final selection will be made based on the criteria identified in this bid opportunity. The preferred models are the following but substitutes (refer B7) may be proposed based on either Manufacturer's recommendations:

- Waukesha VHP F35XX GSI Series
- Caterpillar G3512 TA Series

Bidders are encouraged to submit a separate bid for each of these engine models.

E7.2.6 All drawing engine and appurtenance connection locations have been prepared based on preliminary dimensional information available at time of design, (Caterpillar Model G3512TA natural gas fired engine) but this is not to be considered an indication of the City's preferences. Any costs associated with connection location changes required by use another engine shall be the Contractor's responsibility and all costs shall be included in the bid price.

E7.3 Fuel Gas Train

E7.3.1 The fuel system is to comply with the requirements of the Natural Gas and Propane Installation Code (CSA B149.1) and the Code for the Field Approval of Fuel Related Components on Appliances and Equipment (CSA B149.3).

E7.3.2 The fuel train is to be provided with the engine and will include both engine mounted and unmounted equipment supplied for field connection by the Contractor.

E7.3.3 The system requirements will include:

(a) An inlet, manual isolation valve;

(b) An inlet gas strainer;

(c) A lock up type pressure regulator at the entrance to the valve train;

(d) A pressure relief valve when all components of the gas train are not pressure rated for the inlet supply pressure;

(e) Two automatic safety shut off valves;

(f) High and low gas pressure shut off switches;

(g) A test firing valve;

(h) A heavy duty flexible hose connector for connection at the engine;

(i) A mass flow meter for Natural Gas service.

The engine shall also be equipped with:

(j) A zero governor type regulator;

(k) An automatic speed governor;

(l) A vacuum switch and low oil pressure switch;

(m) Overcrank protection.

E7.3.4 The existing accumulator will be maintained.

E7.3.5 The components not mounted on the engine are to be pre-piped and connected as single assembly for installation in the field by the Installation Contractor. The assembly is to use Schedule 80 ASTM A53 piping for connection of components. For pipe sizes 50mm (2”) and smaller, the components can be threaded. For sizes 62mm (2½”) and larger, all components are to be flanged. Gas flow meter assembly is to be flanged regardless of pipe size. All pipe portions of the assembly are to be painted with a minimum two coats of yellow paint. A stand is to be provided to support the fuel train at 450 mm (18”) above the floor by the engine Manufacturer.

E7.3.6 Provide an insertion type differential pressure mass flow meter; with integral 3-valve manifold, local LCD display, 316 SS sensor, flanged mounting. Associated piping to be Schedule 80 ASTM A53 pipe with 150# flanges. Installation as per Manufacturer’s recommendations. Provide a 4-20mA signal to be connected to the existing PLC for SCADA system alarming/monitoring.

E7.3.7 The available natural gas pressure at the outlet of the pumping station gas meter is 35kPa (5psig). The gas pressure at the inlet to the engine fuel gas train is estimated to maintain at least 31 kPa (4.5 psig).

E7.4 Engine Cooling

E7.4.1 The engine cooling system and all components listed herein will be provided by the engine Manufacturer. It is to include multiple circuits as required for rejection of heat from the engine jacket, oil cooler and aftercooler/intercooler. Each circuit is to be provided with

individual thermostatic controls (mechanical, AMOT or electrically actuated) to maintain the desired system operating temperatures.

E7.4.2 A municipal water cooled heat exchanger(s) for engine jacket cooling shall be used. The engine coolant will be pumped to the heat exchanger before returning to the engine. The engine jacket cooling heat exchanger is to be sized to meet the full engine jacket cooling requirements. Other cooling circuits, such as after cooler/intercoolers, are to use municipal water cooled heat exchangers only.

E7.4.3 The engine coolant is to be a 50/50% mixture of water/ethylene glycol specifically formulated for use in natural gas fired engines.

E7.4.4 The engine jacket coolant system is to be a closed loop design with provision for filling, expansion and venting. An engine mounted surge (expansion) tank, or remote mounted surge (expansion) tank provided with the engine, is to be suitable for the full circuit requirements. Valving, venting, sight glass and low level indication (Murphy switch) are to be included. The system is to operate at a positive static pressure.

E7.4.5 The engine Manufacturer shall provide all mounting brackets for the surge tank.

E7.4.6 A heavy duty, high capacity engine coolant pump is to circulate engine coolant under all conditions of engine load and speed. The pump is to be engine driven and is to have sufficient head capacity to permit a future remote mounted radiator and a water cooled heat exchanger to be utilized. (Allow 103kPa (15psi) for piping, radiator, AMOT control valve and heat exchanger head losses).

E7.4.7 Auxiliary coolant pumps for other cooling circuits are to be engine driven.

E7.4.8 The cooling system is to be designed for a minimum 172kPa (25psi) static pressure.

E7.4.9 An internal engine mechanical thermostat is to regulate engine coolant temperatures separately from external cooling systems until the normal operating temperature is reached.

E7.5 Heat Exchanger

E7.5.1 Heat exchangers and related components are to be supplied by the engine Manufacturer. These are to have sufficient capacity to cool the engine jacket, oil cooler or aftercooler/intercooler circuits at all load conditions. The available municipal water varies in temperature throughout the year from 5 to 25ºC (41 to 77ºF).

E7.5.2 The heat exchangers are to be shell and tube heat exchangers with the municipal water in the tubes. The heat exchangers are to be selected with a fouling factor that provides a total cooling capacity at a minimum of 125% of the total circuit heat rejection at full load operation.

E7.5.3 The heat exchanger is to be designed with the following requirements:

(a) Most efficient water usage;

(b) Minimum 22ºC (71ºF) cooling water temperature rise;

(c) Maximum shell side pressure drop of 14kPa (2psi) with engine coolant;

(d) Maximum tube side pressure drop of 69kPa (10psi);

(e) Pressure rating of 1034kPa (150psi);

(f) Operating temperature range from 5 to 121ºC (41 to 250ºF);

(g) Tube material to be Admiralty brass;

(h) Shell material to be carbon steel;

(i) Maximum tube velocity to be 2.1m/s (6.9ft/s) or less as recommended by the heat exchanger Manufacturer's to minimize erosion of the tube bends.

E7.5.4 Mechanically actuated thermostatic control valves are to be provided for the control of the cooling water supply to each heat exchanger. Each valve is to have a remote mounted capillary bulb and an actuator selected to suit the design range of operation for each circuit. Valves are to be AMOT, Powers, Trerice or Penn. Valves are to be provided with an integral temperature indicating device. In addition to the thermostatic valves, a single air operated block valve is to be supplied for installation into the cooling water supply to each engine. The valve will normally be closed when the engine is off.

E7.5.5 The engine Manufacturer shall supply required brackets to mount the heat exchanger directly to the front of the engine or to the front of the base frame.

E7.5.6 Provide mechanical temperature gauge to indicate heat exchanger discharge to engine temperature. Acceptable product: Winters Instruments, 9" Valox case, 0-115ºC (32-239ºF) 9IT series or approved equal in accordance with B6.

E7.6 Engine Jacket Heater

E7.6.1 Two electric jacket water heater(s) are to be provided by the engine Manufacturer on the engine to maintain the engine coolant at a constant temperature of 32ºC (90ºF) when the engine is off.

E7.6.2 The heaters are to be thermostatically controlled.

E7.6.3 Heaters are to be CSA approved, 120VAC single phase. Connect to existing lighting panel A, circuits 30 and 38.

E7.6.4 Hoses used to connect the heaters to the engine are to be industrial grade and selected for the temperature and operating conditions.

E7.6.5 Manual shut off valves are to be provided to permit isolation of the heaters for servicing.

E7.7 Drive Assembly

E7.7.1 The engine is to be coupled to the pump input shaft through an engine mounted power take off (clutch) and a shaft coupling, all supplied by the engine Manufacturer and:

(a) The clutch shall be installed to the engine by the engine Manufacturer;

(b) The coupling shall be installed on site by the Contractor.

E7.7.2 The pumps are monitored for reverse spin.

E7.7.3 The clutch is to be provided with a manual lever operator and an automatic pneumatic actuator. The actuator is to be sized to provide positive engagement of the clutch and is to operate on 620kPa (90psig) compressed air. Solenoids and limit switches for control and monitoring of clutch engagement and disengagement are to be supplied by the engine supplier.

E7.7.4 The clutch is to include the following:

(a) A complete clutch assembly with shaft and bearings mounted in a cast iron housing for direct engine installation;

(b) Multiple plate, ventilated design;

(c) Sealed pilot bearings;

(d) Tapered roller main bearings. Main bearings to permit the installation of a temperature sensor.

E7.7.5 The clutch is to be sized to suit the maximum start up torque of the connected pump for the described method of start up and is to meet or exceed the rating of the power take offs currently installed on the existing natural gas engines.

E7.7.6 The clutch is to be selected to permit a clutch engagement period of typically 2 seconds, with a minimum engagement time of 1 second. A faster engagement will not be acceptable.

E7.7.7 The selection of the clutch is to be coordinated with the required engine cool down period.

E7.7.8 The clutch is to be as manufactured by Twin Disc.

E7.7.9 The shaft coupling is to be provided complete with a closed type coupling guard (the existing coupling guard may be reworked) and shall meet the following requirements:

E7.7.10 Coupling shall be of the stainless steel flexible disc retained spacer type, with overload collars and guard ring feature.

E7.7.11 Coupling bolts shall be chrome-plated or Stainless Steel to prevent corrosion.

E7.7.12 Exposed surfaces of non-stainless parts shall be impregnated with a rust inhibiting material.

E7.7.13 Coupling shall be rated for a minimum of 800HP @ 1200RPM.

E7.7.14 The coupling is to accept a minimum angular misalignment of ½º. Shaft mounting for both hubs is straight bore finish with single keyways.

E7.7.15 Acceptable Product: Metastream “T” Series, Model TSCS-1400-0077-2540 (10” standard shaft separation) or approved equal in accordance with B6.

E7.7.16 Closed type coupling guard to provide finger safe protection from rotating parts.

E7.8 Lubrication System

E7.8.1 The lubricating system provided by the engine Manufacturer is to be a pressurized distribution system and is to include an oil pressure pump, oil cooler, oil filtration system, oil sump, oil pressure gauge and oil temperature gauge. Oil temperature is to be controlled through the engine cooling system.

E7.8.2 The oil pump is to be engine driven and is to be a positive displacement pump.

E7.8.3 Oil filtering is to be a full flow system including a bypass valve to maintain oil flow in the case of filter blockage. The bypass is to be integral to the engine filter base or receptacle. Duplex oil filters are to be used.

E7.8.4 Disposable filter elements are to be used.

E7.8.5 The oil sump is to be provided with a valved drain to facilitate oil changes.

E7.8.6 Provisions are to be made to permit the engine oil levels to be checked with the engine operating.

E7.8.7 A differential pressure indicator is to be provided by the engine Manufacturer on the oil filter element to identify when the oil filter requires changing.

E7.8.8 A Murphy low oil level shutdown switch is to be provided by the engine Manufacturer.

E7.8.9 A Low Oil Pressure shutdown switch is to be provided by the engine Manufacturer.

E7.8.10 Proper lubrication shall be provided at all times for any turbocharger(s) including during an emergency engine shutdown.

E7.9 Pre-Lube Pump

E7.9.1 A pre-lubrication lubrication pump system is to be provided and installed by the engine Manufacturer to circulate engine lubricating oil when the engine is off. The pump is to be electrically driven, positive displacement, with an internal pressure relief valve set to suit acceptable engine oil pressures and a check valve to prevent reverse flow.

E7.9.2 The pump is to be 120VAC, single phase. Connect to existing lighting panel B, circuits 10 and 14.

E7.9.3 The pump is to be pre piped and mounted.

E7.9.4 The pump is to be sized to provide oil circulation and warming via the oil cooler. Pressurization of the engine oil system should be between 35-69kPa (5-10 psig) at a flow rate of 25-38 lpm (7-10 gpm), or as specified by the engine Manufacturer.

E7.9.5 The Pump is to be controlled by the existing PLC. The PLC program will cycle the pump on and off. The pump on and off times are to be independently adjustable from 1 – 60 minutes.

E7.9.6 Provide mechanical pressure gauge to indicate pre-lubrication system pressure. Acceptable product: Winters Instruments, 2½" liquid filled 0-689kPa (0-100psig), LF series or approved equal in accordance with B6.

E7.9.7 Provide low oil pressure switch (form C contacts, 2 amp., 120VAC rated) to indicate failed pre-lube pump (wired in series with pump control)

E7.9.8 Pump control is to include a "Maintenance Mode" Hand – Off – Auto selector switch. Hand and Auto auxiliary switch contacts are to be connected to the existing PLC for SCADA system alarming/monitoring. Provide form C contacts, 2 amp. 120VAC rated contacts.

E7.10 Electric Starting and Charging System

E7.10.1 Engine Manufacturer is to provide an electrical starting system and related components including but not limited to two 24VDC motor starters, starter relay, automatic reset circuit breaker, 24VDC lead acid batteries and automatic 120VAC charger. The system is to be capable of starting an engine at 20ºC (68ºF) within 10 seconds.

E7.10.2 Both starters are to normally operate. A single starter shall be able to start the engine.

E7.10.3 Batteries are to be maintenance free, lead acid and designed to meet the requirements of the application. Minimum battery size is to provide a cranking time of 60 seconds at 10ºC (50ºF) based on six 10 second cranking attempts. The minimum battery discharge voltage is not to be allowed to drop to less than 80% of the rated voltage.

E7.10.4 A steel frame battery stand with a painted 19mm (¾") thick, marine grade plywood top is to be provided. Acid resistant epoxy paint to be used for both the stand and top.

E7.10.5 An automatic battery charger is to be provided (120VAC to 24VDC). The charger shall have a manual high charge capability and an automatic battery maintenance charging capability. The charger selection is to support the normal engine's operating 24VDC electrical consumption while replacing the energy used in engine starting. A voltmeter and ammeter is to be provided with adjustable battery low voltage and battery fault alarm contacts for connection to the existing pumping station PLC for SCADA system alarming/monitoring. The charger casing is to be ventilated and is to be provided with a stand for floor mounting. The charger is to incorporate limiting circuitry to avoid the need for a crank disconnect relay. Standard of acceptance: Mechron CR2F series or approved equal in accordance with B6. New circuits for the battery charger shall be installed and connected to existing lighting panel B, circuits 28 and 30.

E7.10.6 Power cables from the charger to the battery and the battery to the engine are to be provided. Any required battery interconnection cabling is also to be provided. All cables

are to be sized to suit 125% of the maximum requirements of the electrical circuits they feed.

E7.11 Air Supply

E7.11.1 The engine air cleaner(s) are to be engine mounted with dry element filters. The filters are to be accessible through a quick access cover. The air cleaner housing is to permit the direct connection of a piped air supply.

E7.11.2 Two differential pressure (DP) transmitters are to be installed and connected to indicate the pressure drop across each intake (combustion) air filter and used to determine the requirement for replacement. For each transmitter, provide a local DP display and one 4-20mA signal to be connected to the existing PLC for SCADA system alarming/monitoring.

E7.11.3 Any turbocharger(s) are to be axial turbine type, driven by engine exhaust gases and direct connected to a compressor supplying engine combustion air.

E7.11.4 An aftercooler/intercooler is to be provided by the engine Manufacturer designed to use either engine jacket coolant, or city water supply. The City water supply varies in temperature throughout the year from 5 to 25ºC (41 to 77ºF).

E7.12 Crankcase Ventilation System

E7.12.1 An external crankcase emission filtering system(s) is to be provided on the engine by the engine Manufacturer. The system is to filter and clean the crankcase emissions to allow the gases to be returned to the inlet of the air cleaner.

E7.12.2 The system is to use replaceable filter elements housed in a painted steel housing with quick access covers.

E7.12.3 A DP transmitter is to be installed and connected to indicate the pressure drop across the system filter and used to determine the requirement for replacement. Provide a local DP display and one 4-20mA signal to be connected to the existing PLC for SCADA system alarming/monitoring.

E7.12.4 Collected condensate is to be piped to a floor mounted, 4 litre (0.9 Imperial gallon) plastic container for disposal.

E7.12.5 The filters are to be installed to provide ease of access for replacement of filters.

E7.12.6 The filter system is to be the Nelson EcoVent Recirculator or approved equal in accordance with B6.

E7.13 Engine Exhaust Silencers and Related Components

E7.13.1 Engine Manufacturer shall provide a 90 degree, flexible connection with minimum 37 mm (1-1/2”) axial expansion capacity, providing transition from the engine exhaust outlet to a standard ANSI 250 mm (10”) (nominal) class 150 flange, for each new engine.

E7.13.2 Engine Manufacturer shall provide low pressure drop engine exhaust silencer with flanged inlet and outlet and end in, end out orientation for each new engine. Flange sizes are to be 250mm (10”). Construction is to be 100% type 316 stainless steel.

E7.13.3 Sound attenuation is to be 15-25 dBA.

E7.13.4 Pressure drop is to be below 1kPa (4” w.c.)

E7.14 Engine Controls

E7.14.1 A stand alone microprocessor based engine control system is to be provided by the engine Manufacturer to control all engine functions including:

E7.14.2 Speed governing.

E7.14.3 Spark timing control and detonation protection.

E7.14.4 Start/Stop and Emergency Stop.

E7.14.5 Engine cool down.

E7.14.6 Engine safety including overspeed, low oil level, high coolant temperature and control malfunction.

E7.14.7 Overspeed shut-down shall be sensed by a separate magnetic pick-up off of the engine and the overspeed device shall be a Dynalco overspeed relay (Model No. SW050) or approved equal in accordance with B6.

Note: If engine Manufacturer's standard supplied equipment does not support these functions, engine Manufacturer shall provide and install a panel mounted Modicon Quantum (140CPU31110 processor) PLC programmed to provide the specified operation. The PLC hardware requirements are to be approved by the Contract Administrator.

E7.14.8 The system is to accept external control inputs including Start/Stop and speed reference signals.

E7.14.9 An electronic governor is to be provided by the engine Manufacturer. Speed control from no load to full load is to be within 0.5% of the set speed. The governor is to compensate for engine hunting and stalling. The governor is to accept 4-20mA input control signals with a linear relationship between minimum and maximum pump speeds.

E7.14.10 Controls and system power are to be 24VDC.

E7.14.11 Engine monitoring points required as part of the control system are to include as minimum:

(a) Lube oil pressure, level, and temperature;

(b) Intake manifold temperature and pressure/vacuum;

(c) Jacket water temperature;

(d) Engine speed;

(e) Detonation sensors;

(f) Coolant Low Level;

(g) Exhaust Gas Temperature at outlet connection.

E7.14.12 The system is to maintain a history of all engine faults and shutdowns. Engine Manufacturer shall provide and install any required engine monitoring/control diagnostic software and hardware and all required licenses on two (2) City supplied notebook computers. Alternately, a single code reader/diagnostic tool would be required for each engine.

E7.14.13 The engine control system is to include a display panel providing local engine control, engine status, and indication of alarms.

E7.14.14 The control system is to permit communications with the pumping station Supervisory Control and Data Acquisition (SCADA) system via the existing Modbus Plus PLC network. All necessary interface software, hardware and cabling is to be provided.

E7.14.15 All discrete monitoring points shall be a minimum of 2Amp, form C contacts, 120VAC rated.

E7.14.16 Temperature transmitters shall be Rosemount 644HAK6XAM5J6F6 series complete with Liquid Crystal Display (LCD) local display, thermal well, 100Ω Platinum Resistive Temperature Device (RTD), or approved equal in accordance with B6.

E7.14.17 Pressure transmitters shall be Rosemount 3051S series complete with LCD local display and block & bleed instrument manifold or approved equal in accordance with B6.

E7.14.18 Differential Pressure (DP) transmitters shall be Rosemount 3051S series complete with LCD local display and 3 valve instrument manifold or approved equal in accordance with B6.

E7.14.19 Differential type mass flow transmitters shall be Rosemount 3095MFAG020CCHPS1T100T31CA1ARLJ1M5 series Mass ProBar Flowmeter, complete with LCD local display, 3 valve instrument manifold and 316 Stainless Steel sensor material or approved equal in accordance with B6.

E7.15 Local Indication

E7.15.1 Local indication of the following engine conditions is to be provided by the engine Manufacturer to assist in the maintenance and local supervision of the engine operation and performance. Information is to be provided on an engine mounted panel or at individual engine mounted devices:

(a) Engine oil pressure;

(b) Pre-lube oil pressure;

(c) Jacket water temperature;

(d) Heat exchanger discharge to engine temperature;

(e) Tachometer;

(f) Coolant level;

(g) Oil filter differential pressure;

(h) Air cleaner differential pressure;

(i) Inlet manifold air temperature;

(j) Inlet manifold air pressure;

(k) Service hour meter;

(l) Crankcase emissions filtering differential pressure;

(m) Exhaust gas temperature at each cylinder.

E7.15.2 Gauges are to be suitable for media sensed or equipped with process seals.

E7.16 Monolithic Steel Base Frame

E7.16.1 The following information is included in the Appendix.

E7.16.2 MacLean steel base drawing for original pump and engine

E7.16.3 A steel base to be provided by the engine Manufacturer to suit the installation of the engine(s) and the existing pump(s). The base design is to allow the re-installation of the existing pumps to connect to the existing pump inlet and outlet piping without requiring modifications to the piping. The engine/clutch output shaft is to be set at the same elevation as the pump input shaft.

E7.16.4 Provided this can be met within the existing base frame general dimensions, and site dimensional restrictions, the distance between the engine and the pump shall be sufficient to allow future complete servicing of the clutch by removal of the coupling assembly only, without need to disturb the pump input shaft or engine.

E7.16.5 The base and mounts are to be designed to resist deflection, maintain alignment and minimize resonant vibrations.

E7.16.6 The base is to include openings to permit the flow of grout placed under the steel base to be inspected/ verified. The openings are to be a minimum 75mm (3”) and consist of a half

coupling continuously welded to the base. A cap is to be provided to close the inspection opening.

E7.16.7 A continuous gutter is to be provided around the perimeter of the base. The gutter is to be 100mm (4") wide and range from 25mm (1") deep at the pump end to 75mm (3") deep at the engine end. The gutter is to be continuously welded to the base. A 25mm (1") drain is to be installed at the low end of the gutter complete with 1" lockable ball valve.

E7.16.8 All anchor bolts, nuts, inserts, and shims required for setting and anchoring the base through the concrete base and into the existing 400mm (16") concrete foundation are to be provided.

E7.16.9 The base is to be completely epoxy coated (top, bottom and edges) after manufacture. Coating to be compatible with direct contact with epoxy grout. Colour to match specified engine colour.

E7.17 External Connections

E7.17.1 All mechanical connections to external systems are to be threaded or flanged and shall use proper sealant for the products in use.

E7.17.2 Flexible connectors are to be supplied with the engine by the engine Manufacturer for natural gas, exhaust system, engine cooling water jacket inlet and outlet, aftercooler and or/inlet cooler inlet and outlet.

E7.17.3 Flexible connector(s) to also be provided for the combustion air piping/ducting to engine air filter housing connection(s).

E7.17.4 Flexible connections are to be selected for their specific application of temperature, pressure and material.

E7.18 Explosion Protection

E7.18.1 The crankcase is to be protected by the installation of crankcase mounted explosion vents.

E7.18.2 The explosion vents are to be a spring loaded, self reseating style set to relieve at a pressure to minimize the potential for damage to the engine.

E7.19 Painting and Protective Coatings

E7.19.1 The engine and all auxiliaries that are normally painted are to be provided with two finish coats of oil and coolant resistant paint suitable for temperatures of operation. The paint colour is to match the City of Winnipeg water system green. A paint sample or code will be provided for matching and paint selection.

E7.19.2 All ferrous components shall be dry blasted to near white finish in accordance with National Association of Corrosion Engineers (NACE) NACE/SSPC-SP10 to a degree of cleanliness in accordance with NACE#2 , to obtain a 50 micron blast profile.

E7.19.3 All ferrous surfaces are to be coated before the blasted surfaces deteriorate.

E7.19.4 The gas engine and related equipment shall be factory-coated and finished. Any touch-up paint work required during installation shall be undertaken by the Contractor. The touch-up paint to be used shall be supplied by the engine Manufacturer as per the engine Manufacturer's recommendations.

E7.19.5 The Contractor shall submit with shop drawings, specifications defining the paints that are proposed for use, to the Contract Administrator for review.

E7.19.6 The Contract Administrator shall advise the finishing colours required on the equipment prior to manufacture.

E7.20 Engine Testing – General

E7.20.1 Each engine will be factory tested as indicated prior to acceptance. City of Winnipeg personnel and representatives are to be provided access to witness all factory performance tests. Engine Manufacturer is to perform all field testing.

E7.20.2 Provide minimum of 4 weeks advance notice of the starting date of factory testing to the Contract Administrator.

E7.20.3 Seven (7) certified copies of final test reports are to be provided within one (1) week of successful testing.

E7.20.4 Tests which are aborted due to equipment failure or other causes are to be repeated in full.

E7.20.5 Field testing is not to proceed until the installation and mounting has been fully reviewed by the engine Manufacturer's representative and any identified deficiencies corrected.

E7.20.6 Engine Manufacturer to provide all equipment and accessories required for testing including initial fill of engine lubricating oil and ethylene glycol/water coolant. Cooling water and natural gas will be provided for field testing.

E7.20.7 The points to be monitored at 15 minute intervals during factory and field testing are to include:

Test Point Monitored	Shop/Factory Testing	Field Testing
Time Delay to Start (Crank time)	**X**	**X**
Fuel Consumption	**X**	**X**
Natural Gas Pressure (inlet)	**X**	**X**
Natural Gas Mass Flow (inlet)	**X**	**X**
Water Jacket Outlet Temperature	**X**	**X**
Power Produced	**X**	**N/A**
Shaft Speed	**X**	**X**
Pre-lube Pump Operation	**X**	**X**
Lube Oil Pressure	**X**	**X**
Coolant Pressure at Inlet	**X**	**N/A**
Inlet Manifold Air Pressure	**X**	**N/A**
Test Cell/Room Ambient Temperature	**X**	**X**
Barometric Pressure	**X**	**X**
Battery Charge Rates	**N/A**	**X**
Cycle Crank Test	**N/A**	**X**
Clutch Bearing Temperature	**N/A**	**X**
Exhaust Gas Temp. at each Cylinder	**X**	**X**

The above listed data is to be collected at intervals of no more than 15 minutes throughout the test duration, and at the end of each stage of the test, as the load is varied throughout the test.

E7.21 Factory Testing

E7.21.1 Factory testing is to be performed with the engine coupled to a dynamometer at engine speeds of 1000, 1150 and 1200 RPM for engines #22 and #26. The dynamometer shall be calibrated prior to testing. Pending engine Manufacturer's instructions, factory test procedures are to generally include:

(a) Start engine and run for warm up and pre-test safety check;

(b) Increase load on engine to 100% at speed and hold for 5 minutes;

(c) Decrease load to 0 for 5 minutes;

(d) Stop engine and allow cooling for 30 minutes;

(e) Start engine and increase load to 50% and hold for one hour;

(f) Increase load to 75% and hold for one hour;

(g) Increase load to 100% and hold for two hours;

(h) Stop engine.

E7.21.2 An analysis of engine lubricating oil is to be provided by the engine Manufacturer after factory testing. Engine oil and filter are to be changed prior to shipment.

E7.22 Field Testing

E7.22.1 Allow 4 days on site for testing of each of the two (2) engines. Provide additional time if required due to problems with the engine or supplied equipment.

E7.22.2 Field testing of the engine is not to be performed until all control systems have been verified, operation of the clutch has been tested and verified and a full simulation test (engine off) has been performed by Manufacturer's representative. Coordination with station operators to permit operation of the pump will be needed.

E7.22.3 Field tests are to include:

(a) Start engine through the PLC and use normal start sequence of engine warm up, increase the engine speed to 1000 RPM for MacLean engines, prior to engagement of the clutch;

(b) Run engine at 1150 RPM for 4 hours at available load;

(c) Stop the engine by normal shut-down means including cool down;

(d) Allow engine to cool to ambient temperatures and repeat the test at 1000 RPM for MacLean engines;

(e) Operation of any engine Manufacturer supplied engine management (shut down control systems) disassembled for shipping.

E7.23 Spare Parts

E7.23.1 The following spare parts and materials are to be provided and specifically tagged for each engine at no charge:

(a) Two lubricating oil filters;

(b) Four air cleaner filter elements;

(c) A complete spare set of spark plugs;

(d) Two crankcase emission filters.

E7.24 Special Tools

E7.24.1 Engine Manufacturer to provide, at no extra cost, any special tools, gauges, and diagnostic devices required to perform routine maintenance, and a heavy duty metal tool box for storage of these items.

E7.25 Additional Monitoring

E7.25.1 Engine Manufacturer shall supply and the Contractor shall at appropriate time, install, program and configure I/O registers and scaling for the following instrumentation wired to the existing Pump Local Control Panel, (Bently Nevada TEMP/VIB Monitor and Modicon PLC) as noted in the table below for additional engine and pump monitoring and supervision, at no extra cost. All wire ends and terminals to be identified using mechanically marked, oil and heat resistant tags (self laminating or heat shrink type).

E7.25.2

Type	Tag I.D.	Description	Location	Monitoring Device
AI	LG-04x-TE7	Clutch Outboard Bearing Temp	Engine	LG-04x-TV TEMP/VIB Monitor
AI	LG-04x-PIT-1	Engine Oil Pressure	Engine	Modicon PLC
AI	LyG-04x-DIT-1	Engine Crankcase Filter Differential	Engine	Modicon PLC
AI	LyG-04x-DIT-2	Engine Air Filter Differential – Left	Engine	Modicon PLC
AI	LyG-04x-DIT-3	Engine Air Filter Differential – Right	Engine	Modicon PLC
AI	PCG04xXT1	Engine Vibration LEFT	Engine	LG-04x-TV TEMP/VIB Monitor
AI	PCG04xXT2	Engine Vibration RIGHT	Engine	LG-04x-TV TEMP/VIB Monitor
AI	LyG-04x-FIT-1	Natural Gas Mass Flow	Engine	Modicon PLC
DI	LyG-04x-HS-4	Pre-Lube Pump Maintenance Mode – Hand	Engine	Modicon PLC
DI	LyG-04x-HS-5	Pre-Lube Pump Maintenance Mode – Auto	Engine	Modicon PLC
DI	LyG-04x-EAL1	Battery Condition Fault	Engine	Modicon PLC
DI	LyG-04x-EAL2	Battery Voltage Low	Engine	Modicon PLC

Where x = 2 for Pump No. 22 and x = 6 for Pump No. 26

Where y = B for Pump No. 22 and y = F for Pump No. 26.

E7.25.3 Provide and install (wire to terminal blocks to match existing), for each Engine Control Panel;

(a) One AS-BADU-205 Modicon Compact Analog Input module. Label as SPARE;

(b) One Bently Nevada Dual Velocity Input Monitor 3300/55 series (to match existing);

(c) Two Bently Nevada Velomitors 330500-01-01 c/w appropriate mounting brackets (to match existing);

(d) Two Armoured interconnection cables for Bently Nevada Velomitors (to match existing), length to be determined during installation.

E7.26 Torsional Analysis

E7.26.1 Engine Manufacturer shall provide a torsional analysis of the proposed engine and existing pump combination for each location (Pumps 22 and 26 at MacLean) with the shop drawings.

E7.26.2 Torsional Vibration Analysis Report shall include a mathematical determination of the natural frequencies, amplitudes, critical speeds and approximate nodal locations of the complete elastic system (equivalent shaft) for both engine and driven equipment. Include nominal and extreme loading conditions.

E7.27 Engine Installation

E7.27.1 The engine Manufacturer shall provide technical assistance to the Contractor for the installation of all supplied equipment. This will include a minimum of 4 – 2 day site visits during the installation period for each engine.

E7.28 Clutch Installation

E7.28.1 Engine Manufacturer is to install the clutch prior to shipment; clutch installation and alignment to be in accordance with clutch and engine Manufacturer's guidelines.

E7.29 Training

E7.29.1 The Contractor shall state Prices on Form B – Prices for provision of training to the City staff on the operation and maintenance of the equipment. If no price is provided, the City will receive this training at no extra cost.

E7.29.2 The Contractor shall include for qualified instructor(s) as well as the necessary course materials, all approved by the engine Manufacturer. Training for the equipment shall be conducted prior to completion of the project at the City of Winnipeg site.

E7.29.3 The training shall be provided by the engine Manufacturer or their representative for two days (not more than four hours per session). A total of four training sessions shall be provided: two for operation staff and two for maintenance staff.

E7.29.4 The training shall cover operation and maintenance of all equipment supplied under this contract. The Contractor shall arrange for video recording of each type of training session and provide seven (7) VHS and seven (7) DVD copies of each type of session.

E7.30 Extended Warranty

E7.30.1 The Contractor shall offer, and show any extra cost to extend the engine Manufacturer's standard warranty to cover the following total period, on Form B: Prices.

a) 3 years or 8,000 full load hours, whichever comes first (optional),

E8. DELIVERY

E8.1 Delivery

E8.1.1 Goods shall be delivered, F.O.B. destination, freight prepaid, to the following location within the City of Winnipeg at the dates specified in D16.

MacLean Pumping Station
875 Lagimodiere Boulevard
Winnipeg, MB.

E8.1.2 Bidders will be requested to provide the proposed delivery dates for the engines prior to award of any contract.

E8.1.3 Delivery of the last engine shall occur as soon as possible, but within 24 months of the Award of Contract.

E8.1.4 The engine Manufacturer shall ensure the engines and all accessories are properly packaged and loaded to prevent weather or transport damage.

E8.1.5 The engines are to be prepared for shipment and storage at ambient outdoor design conditions for Winnipeg, including below freezing temperatures.

E8.1.6 The Contractor shall also be responsible for storage and all related handling of engines until the scheduled site installation date.

E9. REMOVAL OF EXISTING ENGINE, BASE FRAME AND DEMOLITION OF FOUNDATION AT MACLEAN PUMPING STATION

E9.1 Contractor shall provide a minimum 60 Calendar Days notification to, and obtain approval from, the Contract Administrator prior to commencement of removal activities for each engine. Work shall begin with engine P26.

E9.2 The City has previously identified and labelled some components in the pumping station as containing or suspected to contain asbestos materials. The Contractor shall remove all asbestos affected by the required works, in conformance with all applicable rules and regulations.

E9.3 The Contractor shall cease all work and notify the City and the Contract Administrator upon discovery of any other suspect materials not previously identified as such by the City.

E9.4 All works shall be coordinated with the Contract Administrator or his designate.

E9.5 The first engine, P26, shall be installed and commissioned prior to commencement of demolition work for the second engine (P22).

E9.6 The Contractor shall provide all necessary materials, resources and equipment to protect City personnel and property during all phases of the demolition work. Refer to Section E2.2 Work Site Cleanliness.

E9.7 Removed surplus materials, including the engine, shall become the property of the contractor.

E9.8 The Contractor shall be responsible for recycling or disposal of surplus items and rubbish in accordance with all applicable legislation, regulations and bylaws.

E9.9 Contractor shall direct all recyclable material to approved centers.

E9.10 The Contractor shall provide documentation confirming the means of disposal of products from demolition and the works in general.

E9.11 The work shall include but not be limited to:

E9.11.1 Disconnection of all controls and electrical power connections to engines.

E9.11.2 Disconnection and temporary capping of compressed air, fuel and water supply to engines.

E9.11.3 Disconnection of combustion air supply systems.

E9.11.4 All work related to removal of materials previously identified as containing or suspected to contain asbestos on engine exhaust system, and on other systems removed for engine removals.

E9.11.5 Removal of existing exhaust systems.

E9.11.6 Drainage and proper disposal of all fluids and filters according to all applicable regulations and by-laws.

E9.11.7 Disconnection of engine from potable water pump.

E9.11.8 Removal of the potable water pumps to allow base frame removal and concrete foundation work. The pump shall be stored on site as instructed by the City.

E9.11.9 Removal of engine and base frame to exterior of MacLean Pumping Station and transport off site for recycling or disposal by approved means.

E10. REPAIRS TO CONCRETE FOUNDATIONS FOR ENGINES AT MACLEAN PUMPING STATION

E10.1 Contractor shall repair existing concrete foundations in accordance with the drawings.

E10.2 Work shall include but not be limited to:

E10.2.1 Hoarding and dust suppression, collection and control. Refer to Section E2.2 Work Site Cleanliness.

E10.2.2 Removal of concrete as indicated on the drawing(s)

E10.2.3 Removal of concrete off site to an approved disposal site.

E10.2.4 Placement of reinforcement, anchor bolt sleeves and bolts, and new concrete as shown on the drawings.

E10.2.5 Placement of new ceramic tiling as shown on the drawings.

E10.3 Work shall be in concurrence with demolition schedule.

E10.4 Concrete shall be from the City of Winnipeg approved supplier list, available from the City web site. http://www.winnipeg.ca/matmgt/Spec

E11. INSTALLATION OF NEW ENGINES AT MACLEAN PUMPING STATION

E11.1 Base Frame Installation and Alignment

E11.1.1 Installation shall not begin until concrete foundation has cured for the specified time to reach the specified hardness.

E11.1.2 Contractor shall place the new base frame in preparation for receipt of new engine and existing potable water pump in accordance with drawings and .

(a) Maintain alignment of potable water pump flanges with existing piping connecting flanges;

(b) According to engine Manufacturer's recommendations, subject to final approval by the Contract Administrator;

(c) Grout to foundation using epoxy grout placed according to the engine Manufacturer and the grout Manufacturer's recommendations.

E11.1.3 Contractor shall measure and record the final elevation of the grouted base frame at all engine and pump support locations, using instruments and methods to provide an accuracy of 0.13 mm (0.005").

E11.1.4 The location of such measurements shall be identified and documented on a plan view drawing (AutoCAD) of the base frame and each location permanently marked and identified on the base frame.

E11.2 Engine Placement and Alignment

E11.2.1 The Contractor shall place the engine on the base frame to provide the following alignment of the engine clutch output shaft and the pump input shaft to the following tolerances, or to 50% of the coupling and engine Manufacturer's maximum values, whichever is most stringent:

(a) Axial misalignment: Maximum +/- 0.001 mm per mm (0.001 inch per inch) of flange diameter;

(b) Parallel misalignment: Maximum +/- 0.001 mm per mm (0.001 inch per inch) of shaft separation.

E11.2.2 The alignments shall be verified by use of a laser based measurement device designed for this type of measurement, providing accuracy to 0.025 mm (0.001") or better.

E11.2.3 These measurements shall be documented and submitted to the City on an AutoCAD drawing showing the clutch output shaft and pump input shaft outlines.

E11.3 Coupling Installation

E11.3.1 The Contractor shall install the coupling provided by the engine Manufacturer, in accordance with the coupling Manufacturer's instructions and the above alignment requirements.

E11.4 Engine Reference Dimensions

E11.4.1 Contractor shall measure the final elevation of the shimmed, installed engine and pump at all engine and pump support locations, using instruments and methods to provide an accuracy of 0.13 m (0.005").

E11.4.2 Each measurement location shall be identified on the drawing and on the components using the same numbering convention as for the base frame recordings.

E11.4.3 The location of such measurements shall be documented on a plan view drawing (AutoCAD) of the engine and pump outline.

E12. INSTALLATION OF ENGINE FUEL AND ENGINE LUBE OIL SYSTEMS AT MACLEAN PUMPING STATION

E12.1 The Contractor shall supply and install all necessary materials and connections for the engines' natural gas fuel systems as specified herein and on the drawings.

E12.2 The Contractor shall supply and install all necessary materials and connections for the engines' lubrication oil system as specified by the engine Manufacturer, herein and on the drawings

E12.3 Work shall include but not be limited to:

E12.3.1 Installation of new natural gas piping, supports, and devices from the existing supply flange connection point to the engine connection point(s).

E12.3.2 Installation of flexible connector(s) supplied by the engine Manufacturer.

E12.3.3 Installation of natural gas flow meter, mounting brackets, piping, connections, and related components as required. Electrical connection to existing PLC.

E12.3.4 Installation of engine oil filtration system, mounting brackets, piping, connections, and related components as required.

E12.3.5 Installation of pre-lube oil pump, piping connections and electrical connections.

E13. INSTALLATION OF ENGINE COOLING SYSTEM AT MACLEAN PUMPING STATION

E13.1 The Contractor shall supply and install all necessary materials and connections for all the engine cooling circuits and systems as specified herein and on the drawings.

E13.2 Work shall include, but not be limited to:

E13.2.1 Installation of engine coolant expansion tank.

E13.2.2 Connections to and from the engine coolant expansion tank and the engine.

E13.2.3 Connections to and from the engine heat exchanger and the engine connection locations.

E13.2.4 City water supply to the heat exchanger, after/inter cooler, and oil cooler circuits.

E13.2.5 Drainage from the heat exchanger, after/inter cooler, and oil cooler circuits to City sewer.

E13.2.6 Flexible connector(s) supplied by the engine Manufacturer.

E13.2.7 Supply and installation of engine coolant.

E13.2.8 Supply and installation of any required components specified by, but not provided by the engine Manufacturer.

E14. INSTALLATION OF COMBUSTION AIR SUPPLY AT MACLEAN PUMPING STATION

E14.1 The Contractor shall supply and install all necessary materials and connections for the engine combustion air systems as specified herein and on the drawings.

E14.2 Work shall include, but not be limited to:

E14.2.1 Painting of outside section of combustion air piping.

E14.2.2 Removal of portions of existing combustion air piping.

E14.2.3 New combustion air piping, ducting, gaskets, and supports.

E14.2.4 Flexible connection to engine air cleaner housings.

E14.2.5 Sealing of wall penetration(s)

E14.2.6 Thermal insulation and jacket.

E15. INSTALLATION OF EXHAUST SYSTEMS AT MACLEAN PUMPING STATION

E15.1 The Contractor and the engine Manufacturer shall supply and install all necessary materials and connections for the engine exhaust systems as specified herein and on the drawings.

E15.2 Work shall include, but not be limited to:

E15.2.1 New piping, gaskets, expansion joints, and supports.

E15.2.2 Preparation and sealing of wall penetration(s)

E15.2.3 Air gap system, covered with two layers of thermal insulation and an outer metal jacket.

E15.2.4 Installation of engine Manufacturer supplied flexible/expansion connector and silencer.

E15.2.5 Expansion joints.

E15.3 All material after the engine flexible connector and directly in contact with exhaust gases shall be type 316L stainless steel.

E15.4 All first layers of insulation shall be rated for maximum operating temperature of at least 650 °C (1200 °F) and shall be asbestos free, mineral wool type, suitable for application to austenitic stainless steels.

E15.5 Second insulation layer shall be rated for a maximum operating temperature of at least 538 °C (1000 °F).

E15.6 All layers of insulation at and within 6 inches of insulation protection shields used to directly support the pipe shall have a minimum compression resistance of 575 pounds per square foot (28 kPa) at 10% deformation as per ASTM C165.

E15.7 Calcium Silicate insulation shall not be used unless specifically approved by the Contract Administrator or the City.

E15.8 Cement type insulation shall be asbestos free and be rated for a minimum 650°C (1200 °F) continuous operation.

E15.9 Any flanges to be 316L stainless steel, standard ANSI class 125 / 150 with raised gasket face.

E15.10 All flange fasteners to be stainless steel.

E15.11 Exhaust pipe gaskets shall be Garlock Heat Shield or approved equivalent in accordance with B6.

E15.12 All exhaust pipe supports shall have saddles designed for the insulation and jacket in use. Saddles shall not be in direct contact with the internal exhaust pipe, except as specified on the drawings for rigid pipe supports.

E16. INTEGRATION OF ENGINE CONTROLS

E16.1 The City of Winnipeg has recently renovated its SCADA (Supervisory Control and Data Acquisitions) system at MACLEAN PUMPING STATION.

E16.2 The Contractor shall supply and install all necessary materials for the connection of engine monitoring and control systems to the existing PLC systems for alarming/monitoring by the City SCADA system as specified herein and on the drawings.

E16.3 Work shall include, but not be limited to:

E16.3.1 Installation of all wiring and conduits required.

E16.3.2 Interconnections to and from engine devices and the City control panel and system.

E16.3.3 Identification of wiring and terminals.

(a) All wire ends shall be identified using self laminating or heat shrink type oil and heat resistant tags;

(b) All terminals to be identified using oil and heat resistant tags;

(c) All tags shall be mechanically marked.

E16.3.4 Testing and commissioning of the system with assistance from the engine Manufacturer.

E16.4 Qualifications:

E16.4.1 Contractor personnel performing work shall be qualified as per section B10.

E17. ELECTRICAL CONNECTIONS AT MACLEAN PUMPING STATION

E17.1.1 The Contractor shall supply and install all necessary materials and connections for the electrical connections as specified herein and on the drawings.

E17.2 Work shall include, but not be limited to:

E17.2.1 Installation of power supply to the battery charger power.

E17.2.2 Installation of charger wiring to batteries.

E17.2.3 Installation of power supply and related controls for engine pre-lube pump.

E17.2.4 Installation of power supply to the engine jacket heaters.

E18. COMMISSIONING AT MACLEAN PUMPING STATION

E18.1 General

E18.1.1 The Contractor shall provide necessary resources to work with the engine Manufacturer to commission each pump driver engine as indicated below.

E18.1.2 The engine Manufacturer's representative shall be present during field testing and commissioning.

E18.1.3 The Contractor shall coordinate all testing with the Contract Administrator, and provide a minimum 7 Calendar Days of prior notice.

E18.1.4 The Contractor shall supply and install all necessary fluids and filters not shipped with the engine, including but not limited to lubricating oil and primary coolant.

E18.2 Field Testing

E18.2.1 Field testing is not to proceed until the installation and mounting has been fully reviewed by the engine Manufacturer's representative and any identified deficiencies corrected.

E18.2.2 Field testing of the engine is not to be performed until all control systems have been verified, operation of the clutch has been tested and verified and a full simulation test (engine off) has been performed by the engine Manufacturer's representative. Coordination with station operators to permit operation of the pump will be needed.

E18.2.3 Contractor to provide all equipment and accessories required for testing including initial fill of engine lubricating oil and ethylene glycol/water coolant. Cooling water and natural gas will be provided for field testing.

E18.2.4 The points to be monitored at 15 minute intervals during factory and field testing are to include:

Test Point Monitored	Shop/Factory Testing	Field Testing
Time Delay to Start (Crank time)	**X**	**X**
Fuel Consumption	**X**	**X**
Natural Gas Pressure (inlet)	**X**	**X**
Natural Gas Flow Rate (inlet)	**X**	**X**
Water Jacket Outlet Temperature	**X**	**X**
Power Produced	**X**	**N/A**
Shaft Speed	**X**	**X**
Pre-lube Pump Operation	**X**	**X**
Lube Oil Pressure	**X**	**X**
Coolant Pressure at Inlet	**X**	**N/A**
Inlet Manifold Air Pressure	**X**	**N/A**
Test Cell/Room Ambient Temperature	**X**	**X**
Barometric Pressure	**X**	**X**
Battery Charge Rates	**N/A**	**X**

Test Point Monitored	Shop/Factory Testing	Field Testing
Cycle Crank Test	**N/A**	**X**
Clutch Bearing Temperature	**N/A**	**X**
Exhaust Gas Temp.	**X**	**X**

The above listed data is to be collected at intervals of no more than 15 minutes throughout the test duration, and at the end of each stage of the test, as the load is varied throughout the test.

E18.2.5 Allow 4 days on site for installation inspection and testing of each of the two (2) engines under direction of Manufacturer's representative. Provide additional time if required due to problems with the engine or supplied equipment.

E18.2.6 Field tests are to include:

(a) Start engine through the PLC and use normal start sequence of engine warm up, increase the engine speed to 1000 RPM for MacLean engines, prior to engagement of the clutch;

(b) Run engine at 1150 RPM for 4 hours at available load;

(c) Stop the engine by normal shut-down means including cool down;

(d) Allow engine to cool to ambient temperatures and repeat the test at 1000 RPM for MacLean engines;

(e) Operation of any Manufacturer supplied engine management (shut down control systems) originally disassembled for shipping.

E18.2.7 Verify all engine components, mechanical piping, ducting and connections for signs of leakage, and repair to the satisfaction of the City.

E18.2.8 Re-torque fasteners as per Manufacturer's instructions or generally accepted trade practice.

E18.2.9 Touch up all coated exterior surfaces as required with matching product.

E18.3 500 Hour Service and Inspection

E18.3.1 Upon being notified of each engine having been in loaded service for 500 hours, the Contractor shall provide the inspection services specified by the engine Manufacturer. The inspection shall be performed by a qualified technician from the engine Manufacturer or its representative.

E18.3.2 The service and inspection shall include but not be limited to the following:

E18.3.3 General inspection as per engine Manufacturer's checklist

E18.3.4 Perform crankcase oil sampling, laboratory analysis, and written condition report.

(a) Oil sample shall be analyzed for:

(i) External contaminants (fuel, coolant, water);

(ii) Metal particles;

(iii) Sulfated ash;

(iv) Other insoluables (dirt, carbon, etc.).

(b) Provide written analysis report with comments and any recommendations (3 written or 1 electronic copy).

E18.3.5 Inspect and adjust valve clearances.

E18.3.6 Inspect a minimum of one of the crankshaft main bearings and one of the rod bearings. These may be reused unless damaged. If any damage is observed, all other such bearings shall be inspected.

E18.3.7 Supply and change out of all engine lubricants and all engine filters, including disposal according to applicable regulations and bylaws.

E18.3.8 Provide a written report of findings, service work performed, and any recommendations.

E18.4 Final Acceptance

E18.4.1 Prior to the warranty expiry date the Contractor shall, in the presence of the City and the Contract Administrator, perform an inspection for deficiencies on each engine.

E18.4.2 The inspection shall be based on the service checklist as may be provided by the Manufacturer for such purposes, or based on the checklist used at the 500 hour service inspection.

E18.4.3 The Contractor shall provide a written report of findings to the Contract Administrator at least 2 weeks prior to the warranty expiry date.

E18.4.4 The Contractor shall be responsible for resolution of all warranty items thus discovered, or as may otherwise be indicated by the City during the warranty period.

E18.4.5 Final acceptance shall be upon the issue of Form 106 - Certificate of Acceptance.

E19. REBUILD OF WAUKESHA ENGINES AT MCPHILLIPS STATION

E19.1 Background

E19.1.1 The McPhillips Pumping Station has three natural gas engine driven pumps, Pumps # 1, #3 and #5. The engines for pumps #1 and #5 are Waukesha L5790GU naturally aspirated units with approximately 5,000 and 8,000 hours respectively of running time. These engines are operated in a similar manner to those at the MACLEAN PUMPING STATION, as described in section E3.

Engine#	Serial #	Arrangement Code
P1	134405	G
P5	134406	G

E19.1.2 Based on an independent evaluation of the condition of the engines in Spring 2006, the City has established a list of components to be rebuilt or replaced as specified in this section. Pertinent portions of this report are included in Appendix E.

E19.1.3 All other engine components are to remain intact unless otherwise specified and approved by the City.

E19.2 Qualifications

E19.2.1 Contractor personnel performing work shall be qualified as per section B10.

E19.3 Summary of Work:

E19.3.1 The Contractor shall provide the scope of work described below, including but not limited to:

(a) Oil sampling analysis and report;

(b) Replacement of:

(i) 12 engine cylinder heads per engine

(ii) 12 exhaust manifold segments per engine (optional)

(iii) 3 engine piston and liner assemblies per engine

(iv) 3 connecting rod bushing and bearings, and inspection of rods per engine.

(v) Lubricating oil and filters

(vi) Other engine filters

(vii) Engine primary coolant

(viii) Drive belts

(c) Inspection of two (2) main bearings;

(d) Provide written report of observed conditions to the City, along with recommendations for any additional work not previously identified;

(e) Provide itemized price schedule for each item normally part of a standard “top end” engine rebuild work as would normally be provided at the 20,000 hour (nominal) service life;

(f) Start-up and re-commissioning of engine.

E19.4 Work Procedures

E19.4.1 Perform all work in conformance with:

(a) Engine Manufacturer’s repair and maintenance manuals including updates or service bulletins issued for the product;

(b) All applicable Federal, Provincial, City and other applicable codes, rules, regulations and bylaws;

(c) Generally accepted industrial trade practices.

E19.4.2 Have available on site all reference documents listed above for consultation by employees, the City and the Contract Administrator.

E19.5 Materials

E19.5.1 All replacement parts or assemblies shall be:

(a) Original Equipment Manufacturer (OEM) items; or

(b) Items built to OEM's specifications from a company having a minimum of 10 years of experience in the supply of these parts, or

(c) Items remanufactured to the OEM specifications.

E19.5.2 The supplier shall provide documentation at no additional cost indicating the source and conformance of engine parts to the above requirements.

E19.5.3 All replacement parts shall carry a warranty equivalent to that of a new OEM supplied part.

E19.5.4 All other parts to be replaced and not originally provided by the engine Manufacturer shall be supplied in kind from the same Manufacturer that originally supplied the item. Should said item no longer be available, an equivalent item, based on performance and dimensions shall be presented for approval by the City as an Approved equivalent in accordance with B6 or an Approved Substitute.

E19.5.5 The following products shall be as specified or recommended by the engine Manufacturer, unless otherwise requested or approved by the city.

(a) Engine lubricating oil and filters;

(b) All other filters;

(c) Engine primary coolant;

(d) Drive belts.

E19.6 Initial Performance and Engine Acceptance

E19.6.1 Provide written report of all visible leaks and defects, with digital colour photos in support (subject to City approval).

E19.6.2 Perform crankcase oil sampling, laboratory analysis, and written condition report.

(a) Oil sample shall be analyzed for;

(i) External contaminants (fuel, coolant, water);

(ii) Metal particles;

(iii) Sulfated ash;

(iv) Other insoluables (dirt, carbon, etc.);

(b) Provide written analysis report with comments and any recommendations (3 written or 1 electronic copies).

E19.7 Top End Work

E19.7.1 The existing engines are believed to still be equipped with original narrow exhaust bridge cylinder heads. The base pricing is for rebuild of these heads. Optional unit pricing is requested for newer wide exhaust bridge heads, in either exchange or new versions.

E19.7.2 Remove and replace 12 complete cylinder head assemblies on each engine.

E19.7.3 Replace 12 exhaust manifold segments and all seals and gaskets (optional).

E19.7.4 Head castings shall be:

(a) Inspected to confirm flatness of deck contact surface, to OEM specifications;

(b) Visual and dye penetrant inspected for cracks in and around the combustion chamber including the area between intake and exhaust valve seats;

(c) Leakage (hydro) tested prior to being installed on the engine;

(d) Replaced if above criteria cannot be met by OEM approved methods;

(e) External exposed surfaces shall be painted to match existing engine colours.

E19.7.5 Cylinder heads shall include the following new components, as a minimum:

(a) intake valves;

(b) exhaust valves;

(c) valve guides and seals;

(d) all other wearing parts;

(e) springs shall be inspected by visual and Non Destructive Testing (NDT) methods;

(f) valve keepers and retainers shall be visually inspected and replaced if any damage is observed;

(g) head gasket(s), o-rings and other required seals and gaskets.

E19.7.6 The following components may be reused if there are no visible or other signs of damage.

(a) Existing mounting studs (any cap screw assemblies shall be replaced with new cap screws to OEM specifications);

(b) Existing flat and locking washers and nuts.

E19.7.7 Verify the valve actuator or valve lift available at the cylinder head according to Manufacturer's specifications and compare with Manufacturer's specifications for replacement recommendations.

E19.8 Piston and Liner Work

E19.8.1 Visual inspection of all cylinder liners after removal of cylinder heads.

E19.8.2 Visual inspection of water jackets, o-rings, seals and other surfaces exposed by liner removal.

E19.8.3 Provide written report of observed conditions to the City, along with recommendations for any additional work not previously identified.

E19.8.4 Replacement of 3 piston and 3 liners in each of the two engines as indicated below. Locations are as viewed facing the font of the engine (at end opposite from the pump) with numbers starting at the front:

(a)	Pump Engine # 1 Liner locations:	Left #1	Left #3	Right #3
(b)	Pump Engine # 5 Liner Locations:	Left #1	Left #2	Left #5

E19.8.5 The following new components shall be included:

(a) Piston;

(b) Piston Rings;

(c) Rod end bushings and any retainers;

(d) Wrist Pin;

(e) Liner;

(f) Liner o-rings, and required seals and gaskets;

(g) Crankcase inspection door gaskets and seals.

E19.8.6 Perform additional piston and liner replacements as may be approved by the City, at the rates quoted in the Bid Price (optional).

E19.8.7 Perform NDT of connecting rods for any pistons being removed.

E19.8.8 Install new rod end bushings and new connecting rod bearings at all locations where piston is removed, unless otherwise approved by the City.

E19.8.9 Inspect and replace connecting rod bolts as required or recommended by the engine Manufacturer.

E19.9 Bottom End Works

E19.9.1 Inspect two crankshaft main bearings and provide written report on condition. Re-apply bearings unless damaged and replacement approved by the City.

E19.10 Other Related Works

E19.10.1 Contractor shall drain as appropriate and replace the following items with the type and quantity recommended by the engine Manufacturer or as requested or approved by the City. Disposal of used product shall be in conformance with applicable regulations and bylaws.

(a) Engine Lube oil and filters;

(b) Engine system filters;

(c) Engine primary coolant;.

(d) All drive belts.

E19.10.2 Perform general inspection of rotating assemblies driven by the belts and provide written report to the City, complete with any recommendations and itemized quote for proposed additional work not included in the base specification and resultant bid price.

E19.10.3 Perform other works, as may be required and authorized by the City, including but not limited to

(a) Additional main bearing replacements (optional);

(b) Connecting rod bearing replacements (optional);

(c) Machinery of engine block top deck (optional).

E19.11 Engine Commissioning

E19.11.1 The Contractor shall coordinate all testing with the Contract Administrator, and provide a minimum 7 Calendar Days of notice prior to the start of testing.

E19.11.2 With assistance from the City, perform the following tests:

(a) Start engine and use normal start sequence of engine warm up, increase the engine speed to 960 RPM prior to engagement of the clutch;

(b) Run engine at 1150 RPM for 4 hours at available load;

(c) Stop the engine by normal shut-down means including cool down;

(d) Allow engine to cool to ambient temperatures;

(e) Repeat the above test at 960 RPM;

(f) Verify all replaced components, seals and connections for signs of leakage, and repair to the satisfaction of the City.

E19.11.3 Re-torque fasteners for any items removed during the course of work, as per Manufacturer's instructions or generally accepted trade practice.

E19.11.4 Touch up the coated exterior engine surfaces of replaced items as required.

E19.12 Engine Maintenance Service

E19.12.1 500 Hour Service and Inspection – Waukesha rebuilt engines.

E19.12.2 Upon being notified of each engine having been in loaded service for 500 hours, the Contractor shall provide a qualified technician from the engine Manufacturer or its representative to:

(a) Perform crankcase oil sampling, laboratory analysis, and written condition report;

(b) Oil sample shall be analyzed for:

(i) External contaminants (fuel, coolant, water);

(ii) Metal particles;

(iii) Sulfated ash;

(iv) Other insoluables (dirt, carbon, etc.) ;

(c) Provide written analysis report with comments and any recommendations (3 written or 1 electronic copy);

(d) Inspect and adjust valve clearances;

(e) Change out of all engine lubricants and all engine filters, including disposal according to applicable regulations and bylaws;

(f) Provide a written report of findings, service work performed, and any recommendations.

E19.13 Warranty

E19.13.1 The warranty shall be a minimum of 6 months for all labour and 12 months for all parts, and shall otherwise be in conformance with the Warranty requirements specified in Part D of the Bid Opportunity.

E19.14 Final Acceptance

E19.14.1 Final acceptance shall be upon the issue of Form 106 - Certificate of Acceptance.

E20. REMOVAL OF 3 EXISTING EXHAUST SYSTEMS AT MCPHILLIPS PUMPING STATION

E20.1 Contractor shall coordinate these works with the Contract Administrator to suit the planned rebuild of the two Waukesha engines and as acceptable for the third engine (Caterpillar) prior to commencement of removal activities for each engine.

E20.2 The City has previously identified and labelled some components in the pumping station as containing or suspected to contain asbestos materials. Any asbestos affected by the exhaust syatem works shall be removed and disposed of in accordance with all applicable rules and regulations.

E20.2.1 The Contractor shall cease all work and notify the City and the Contract Administrator upon discovery of any other suspect materials not previously identified as such by the City.

E20.3 All works shall be coordinated with the Contract Administrator or his designate.

E20.4 The first engine shall be completed and commissioned prior to commencement of demolition work for the second engine, and likewise for start of work to the third engine systems.

E20.5 The Contractor shall provide all necessary materials, resources and equipment to protect City personnel and property during all phases of the demolition work.

E20.6 Removed surplus materials, shall become property of the contractor.

E20.7 The Contractor shall be responsible for recycling or disposal of surplus items and rubbish in accordance with all applicable legislation, regulations and bylaws.

E20.8 Contractor shall direct all recyclable material to approved centers.

E20.9 The Contractor shall provide documentation confirming the means of disposal of products from demolition and the works in general.

E20.10 Work shall include but not be limited to:

E20.10.1 Removal of all existing exhaust system components after the existing Caterpillar engine (P3) flexible connector as indicated on the drawings.

E20.10.2 Removal of all existing exhaust system components after the existing flexible connector on the two Waukesha engines (P1 and P5).

E21. INSTALLATION OF EXHAUST SYSTEMS AT MCPHILLIPS PUMPING STATION

E21.1 The Contractor and the engine Manufacturer shall supply and install all necessary materials and connections for the engine exhaust systems as specified herein and on the drawings.

E21.2 The existing exhaust silencer, external supports, and guards shall be reused for the Caterpillar (P3) engine.

E21.3 The existing external exhaust supports and guards shall be reused for the two Waukesha engines (P1 and P5).

E21.4 Work shall include, but not be limited to supply and installation of:

E21.4.1 New exhaust piping, gaskets, expansion joints, and pipe supports from engine flexible connector.

E21.4.2 Air gap insulation system, covered with two layers of thermal insulation and an outer metal jacket.

E21.4.3 Expansion joints.

E21.4.4 New exhaust silencers for P1 and P5.

E21.4.5 Note: New exhaust manifolds may be required for the two Waukesha engines (optional – refer to Section E19).

E21.5 All material after the existing engine flexible connector and directly in contact with exhaust gases shall be type 316L stainless steel.

E21.6 All first layers of insulation shall be rated for maximum operating temperature of at least 1200 °F (650 °C) and shall be asbestos free, mineral wool type, suitable for application to austenitic stainless steels.

E21.7 Second insulation layer shall be rated for a maximum operating temperature of at least 1000 °F (537 °C).

E21.8 All layers of insulation at and within 6 inches of insulation protection shields used to directly support the pipe shall have a minimum compression resistance of 550 pounds per square foot (28 kPa) at 10% deformation as per ASTM C165.

E21.9 Calcium Silicate insulation shall not be used unless specifically approved by the Contract Administrator or the City.

E21.10 Cement type insulation shall be asbestos free and be rated for a minimum 1200 °F (650°C) continuous operation.

E21.11 Any flanges to be 316L stainless steel, standard ANSI class 125 / 150 with raised gasket face.

E21.12 All flange fasteners to be stainless steel.

E21.13 Exhaust pipe gaskets shall be Garlock Heat Shield or approved equivalent in accordance with B6.

E21.14 All exhaust pipe supports shall have saddles designed for the insulation and jacket in use. Saddles shall not be in direct contact with the internal exhaust pipe, except as specified on the drawings for rigid pipe supports.

E21.15 The silencers shall be 100% 316 stainless steel “residential grade” low pressure drop exhaust silencers with 10” flanged connectors, end-in end-out configuration.

- Sound attenuation minimum 20 dBA
- Pressure drop to be less than 1 kPa (4” W.C.) at engine rated flow

E22. FORMS

E22.1 The following forms may be used as part of the Contract and some samples are included in this document.

Form 100 – Certificate of Equipment Delivery
Form 101 – Certificate of Instruction
Form 102 – Certificate of Satisfactory Installation
Form 103 – Certificate of Equipment Satisfactory Performance
Form 105 – Certificate of Total Performance
Form 106 – Certificate of Acceptance
Form T1 – Certificate of Satisfactory Training

E23. MCPHILLIPS STATION APRIL 2006 ENGINE INSPECTION REPORT

E23.1 The 2 page report of the inspection performed on the McPhillips Pumping Station engines #1 and #3 is included in Appendix E for reference only.

FORMS

THE CITY OF WINNIPEG

FORMS

INDEX TO FORMS

CERTIFICATE OF EQUIPMENT DELIVERY:
FORM 100

We certify that the equipment listed below has been delivered into the care of the Installation Contractor. The equipment has been found to be in satisfactory condition and meets its Basic Design Criteria. No defects in the equipment were found.

Project: _____

Item of Equipment: _____

Tag No.: _____

Reference Specification: _____

_____

(Authorized Signing Representative of the Installation Contractor) (Date)

_____

(Authorized Signing Representative of the Contractor) (Date)

_____

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

CERTIFICATE OF INSTRUCTION:
FORM 101

I have completed instruction of the installation of the equipment listed below:

(Authorized Signing Representative of the Contractor) (Date)

I certify that the party responsible for the installation of the equipment listed below has received satisfactory instructions from the Contractor.

(Authorized Signing Representative of the Installation Contractor) (Date)

Project: _____

Item of Equipment: _____

Tag No.: _____

Reference Specification: _____

CERTIFICATE OF SATISFACTORY INSTALLATION
FORM 102

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

Project: _____

Item of Equipment: _____

Tag No.: _____

Reference Specification: _____

Outstanding Defects: _____

_____

(Authorized Signing Representative of the Contractor) (Date)

CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE
FORM 103

We certify that the equipment listed below has been validated and has been operated for at least seven (7) consecutive days and that the equipment operates satisfactory and meets its Basic Design Criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

Project: _____

Item of Equipment: _____

Tag No.: _____

Reference Specification: _____

_____

(Authorized Signing Representative of the Contractor) (Date)

_____

(Authorized Signing Representative of the Installation Contractor) (Date)

_____

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

1. Acknowledgement of Receipt of Training for Operation Staff

_____

(Authorized Signing Representative of the City) (Date)

2. Acknowledgment of Receipt of Training for Maintenance Staff

_____

(Authorized Signing Representative of the City) (Date)

FORM 105

THE CITY OF WINNIPEG

CERTIFICATE OF TOTAL PERFORMANCE - REF. GENERAL CONDITIONS FOR THE SUPPLY AND DELIVERY OF GOODS – GC.9.03- MEASUREMENT AND PAYMENT

PROJECT DESCRIPTION

PROJECT:
PROJECT OR CONTRACT NO.:
TOTAL BID PRICE $:
FINAL CONTRACT AMOUNT $:
ASSESSED LIQUIDATED DAMAGES $:

FINAL INSPECTION

A FINAL INSPECTION FOR THE WORK AS DETAILED IN THE CONTRACT DOCUMENTS AND AGREEMENT BETWEEN THE CITY OF WINNIPEG AND _____ (CONTRACTOR)
WAS COMPLETED ON _____

SUPPORT DOCUMENTATION - THE FOLLOWING DOCUMENTS HAVE BEEN RECEIVED BY THE CITY AS REQUIRED BY THE CONTRACT DOCUMENTS:

1. ALL DOCUMENTS FROM THE MANUFACTURER OR THEIR AGENTS WITH RESPECT TO THE GOODS BEING SUPPLIED OR DELIVERED UNDER THIS CONTRACT (I.E. WARRANTY, MANUALS).

2. IF APPLICABLE, CERTIFICATES OR LETTERS FROM THE MANUFACTURERS OR THEIR AGENTS OF ANY EQUIPMENT INSTALLED UNDER THIS CONTRACT STATING THAT THEY HAVE INSPECTED THE INSTALLATION AND CERTIFY THAT THE INSTALLATION IS PROPER AND IS IN SATISFACTORY OPERATING CONDITION. THE ITEMS REFERED TO ARE AS FOLLOWS:
   _____

3. IF APPLICABLE, LETTERS OF ACCEPTANCE HAVE BEEN RECEIVED FROM THE FOLLOWING "AUTHORITIES HAVING JURISDICTION" OUTSIDE OF THE CITY OF WINNIPEG:
   _____

DECLARATION - CONTRACT ADMINISTRATOR

I (WE) HEREBY CERTIFY THAT THE ENTIRE WORK, EXCEPT THOSE ITEMS ARISING FROM THE PROVISIONS OF GC:10 - WARRANTY, HAVE BEEN PERFORMED TO THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

CERTIFIED BY _____ DATE _____
CONTRACT ADMINISTRATOR

DATE OF CERTIFICATE OF TOTAL PERFORMANCE

YEAR	MONTH	DAY
20		

DATE FOR COMMENCEMENT OF WARRANTY PERIOD

YEAR	MONTH	DAY
20		

DECLARATION - CONTRACTOR (PURSUANT TO GC.9 OF THE GENERAL CONDITIONS)

I (WE) _____(CONTRACTOR)
HEREBY CONCUR WITH THIS CERTIFICATE AND DECLARE THAT ALL DISPUTES EITHER WITH THE CITY OR WITH ANY OTHER PARTY, ARISING OUT OF THE PERFORMANCE OF THE WORK OR ANYTHING INCIDENTAL THERETO, HAVE BEEN SETTLED.

SIGNATURE _____ DATE _____

ACCEPTANCE OF CERTIFICATE OF TOTAL PERFORMANCE BY MANAGER OF ENGINEERING – WATER & WASTE DEPT.

SIGNATURE _____ DATE _____

FORM106

THE CITY OF WINNIPEG

CERTIFICATE OF ACCEPTANCE

PROJECT DESCRIPTION

PROJECT:
PROJECT OR CONTRACT NO.:
TOTAL BID PRICE:
FINAL CONTRACT AMOUNT:
ASSESSED LIQUIDATED DAMAGES:

ACCEPTANCE INSPECTION

AN ACCEPTANCE INSPECTION FOR THE WORK AS DETAILED IN THE CONTRACT DOCUMENTS AND AGREEMENT BETWEEN THE CITY OF WINNIPEG AND _____(CONTRACTOR) WAS COMPLETED ON_____20__.

DECLARATION - CONTRACT ADMINISTRATOR

I (WE) HEREBY CERTIFY THAT THE WARRANTY PERIOD EXPIRED ON THE_____(DAY)OF_____(MONTH) 20 ____ (YEAR) AND THAT THE WORK WAS PERFORMED SATISFACTORILY DURING THE WARRANTY PERIOD. THE CONTRACTOR REMEDIED ALL DEFECTS, DEFICIENCIES OR OTHERWISE IDENTIFIED BY THE CONTRACT ADMINISTRATOR DURING THE WARRANTY PERIOD IN THE MANNER PRESCRIBED AND TO THE SATISFACTION OF THE COMMISSIONER, AND SUCCESSFULLY CONCLUDED ALL TESTS REQUIRED BY THE CITY IMMEDIATELY PRECEDING THE CONCLUSION OF THE WARRANTY PERIOD.

CERTIFIED BY_____ DATE _____

CONTRACT ADMINISTRATOR

DATE OF CERTIFICATE OF TOTAL PERFORMANCE

YEAR	MONTH	DAY	
20			**(THIS DATE REPRESENTS THE COMMENCEMENT OF THE WARRANTY PERIOD)**

DECLARATION - CONTRACTOR

I (WE) _____(CONTRACTOR) HEREBY CONCUR WITH THIS CERTIFICATE AND ACKNOWLEDGE THAT THIS CERTIFICATE SHALL NOT HOWEVER RELIEVE US FROM OUR RESPONSIBILITIES AS A RESULT OF ANY BREACH OF THIS CONTRACT BY US, INCLUDING BUT NOT LIMITED TO FAULTY OR DEFECTIVE WORK APPEARING AFTER THE CERTIFICATE OF ACCEPTANCE HAS BEEN ISSUED, FAILURE OF THE WORK TO COMPLY WITH THE CONTRACT DOCUMENTS OR THE REQUIREMENT TO COMPLY WITH THE TERMS OF ANY SPECIAL GUARANTEES SET OUT IN THE SUPPLEMENTAL CONDITIONS.

SIGNATURE_____ DATE _____

ACCEPTANCE OF CERTIFICATE OF ACCEPTANCE BY MANAGER OF ENGINEERING – WATER & WASTE DEPT.

SIGNATURE _____ DATE _____

CERTIFICATE OF SATISFACTORY TRAINING
FORM T1

I have completed training of the City of Winnipeg staff regarding the Operation and Maintenance of the equipment listed below as specified in the Bid Opportunity.

_____

(Authorized Signing Representative of the Contractor) (Date)

Project: _____

Bid Opportunity No.: _____

Equipment: _____