THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 730-2005

SUPPLY, DELIVERY, SUPERVISION OF THE INSTALLATION AND COMMISSIONING OF NATURAL GAS ENGINE DRIVES FOR MACLEAN PUMPING STATION

TABLE OF CONTENTS

PART B - BIDDING PROCEDURES

B1. PROJECT TITLE

B1.1 SUPPLY, DELIVERY, SUPERVISION OF THE INSTALLATION AND COMMISSIONING OF NATURAL GAS ENGINE DRIVES FOR MACLEAN PUMPING STATION

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 4:00 p.m. Winnipeg time, June 28, 2006.

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

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

B3. SITE INVESTIGATION

B3.1 Further to GC.2.01, the Contract Administrator or an authorized representative will be available at the Site from 1:00PM to 3:00PM on June 14, 2006 to provide Bidders access to the Site.

B3.2 The Bidder will not be allowed to take photographs. Upon prior request, the City will arrange to take photographs for the Bidder, but reserves the right to limit the content of the photographs for security reasons.

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

B4. ENQUIRIES

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

B4.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall 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 B3 unless that response or interpretation is provided by the Contract Administrator in writing.

B5. ADDENDA

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

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

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

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site for addenda shortly before the Submission Deadline.

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

B6. SUBSTITUTES

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

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

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least seven (7) Business Days prior to the Submission Deadline.

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

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

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

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

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

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

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

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

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

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

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

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

B7. BID SUBMISSION

B7.1 The Bid Submission consists 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 All components of the Bid Submission shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely in ink, to constitute a responsive Bid.

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

B7.3.1 Samples or other components of the Bid Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder’s Bid Submission.

B7.4 Bid Submissions submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.5 Bid Submissions 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 shall be original and shall 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 Submission 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 each Form B: Prices.

B9.1.1 Identified on each Form B: Prices shall include:

(a) duty;

(b) freight and cartage;

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

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

B9.2 In addition to prices, the Bidder shall provide the additional information requested on each Form B: Prices.

B9.3 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.

B9.4 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, or if the Bidder does not carry on business in Manitoba, in the jurisdiction where the Bidder does carry on business;

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

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

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

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

(f) employ only Subcontractors who:

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

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

B10.2 The Bidder shall be prepared to submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B10.3 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

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.

B11.2 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 Bid Submissions will not be opened publicly.

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 Submission may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

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

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 shall:

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

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

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

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

B15. EVALUATION OF BIDS

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

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

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

(c) Evaluated Bid Price;

(d) Support Services;

(e) 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 Submission is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements if the interests of the City so require.

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 Submission or in other information required to be submitted, that he is responsible and qualified.

B15.4 Further to B15.1(c), the Evaluated Bid Price shall be the Total Bid Price adjusted for the comparison of bids only, by costs as defined in 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.

B15.5 Further to B15.1(d), the Support Services shall be evaluated by considering the information submitted on Form B: Prices

B15.6 This Contract may be awarded separately by (Alternative 1) or (Alternative 2) as identified on Form B: Prices

B15.6.1 The Bidder may, but is not required to, bid on both alternatives.

B15.6.2 The City shall not be obligated to award any alternative to the responsible Bidder submitting the lowest evaluated responsive Bid for that alternative and shall have the right to choose the alternative which is in its best interests. If the Bidder has not bid on both alternatives, he shall have no claim against the City if his Bid is rejected in favour of an award of the Contract on the basis of an alternative upon which he has not bid.

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 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.

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

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

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

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

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

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

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

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

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of the supply, delivery, and supervision of the installation and commissioning of 2 (two) Natural Gas Engine Drives to the MacLean pumping station.

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

(a) Supply, Delivery and Supervision of the installation and commissioning of 2 Natural Gas Engine Drives to MacLean pumping station.

(b) Provision of performance verification and support services

(c) Provision of training and operations and maintenance manuals

(d) Assistance during installation and commissioning

(e) Provision of spare parts.

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

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

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

(c) “**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;

(d) **Substantial Performance** shall have the meaning attributed to it in the Builders’ Lien Act (Manitoba), or any successor legislation thereto;

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

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

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

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

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

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

(k) **IEC** means International Electro-technical Commission

(l) **ISO** means International Standards Organization

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

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

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

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

(q) **CEC** means Canadian Electrical Code

(r) **LOX** means liquid oxygen

(s) **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.

(t) **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.

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

(v) **Furnish** means supply

(w) **ISA** means the Instrumentation Systems and Automation Society

(x) **Total Performance** means that the entire Work, except those items arising from the Provision of GC.10.01 have been performed in accordance with this Contract

(y) **AGMA** means American Gear Manufacturer's Association.

(z) **API** means American Petroleum Institute

(aa) **EEMAC** means Electrical and Electronic Manufacturers Association of Canada

(bb) **VSD** means Variable Speed Drive

(cc) **VFD** means Variable Frequency Drive

(dd) **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

(ee) **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

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

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

(hh) **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 E3.1of 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.

D3.2 The definitions of technical terms, abbreviations, and symbols will be those of the American Society for Testing and Materials, Canadian Standards Association and the applicable Codes and Standards. In the event of a dispute, the Contract Administrator's decision will be final.

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
Facsimile No. (204) 475-3646

D5. NOTICES

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

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

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

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

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

Facsimile No.: (204) 949-1174

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

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

Facsimile No.: (204) 947-9155

SUBMISSIONS

D6. INDEMNITY

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

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

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

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

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

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

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

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

D7. AUTHORITY TO CARRY ON BUSINESS

D7.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D8. WORKERS COMPENSATION

D8.1 The Contractor shall be registered with the Workers Compensation Board of Manitoba, shall provide and maintain Workers Compensation coverage throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request. City to confirm that Site assistance/testing supervisor requires above, and D9 also.

D9. INSURANCE

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

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

D9.2 Deductibles shall be borne by the Contractor.

D9.3 The Contractor shall provide the Contract Administrator with a certificate of insurance of each policy 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 GC.3.01 for the return of the executed Contract.

D9.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

D10. PERFORMANCE SECURITY

D10.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

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

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

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

D10.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D10.2 If the bid security provided in his Bid Submission 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 GC.3.01 for the return of the executed Contract.

D11. SECURITY CLEARANCE

D11.1 Each individual proposed to perform Work under the Contract shall be required to obtain a Criminal Record Search Certificate from the police service having jurisdiction at his place of residence.

D11.2 Prior to the commencement of any Work, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Contract Administrator with a Criminal Record Search Certificate obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform Work within City facilities or on private property.

D11.3 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to property offences or crimes against another person, will not be permitted to perform any Work within City facilities or on private property.

D11.4 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.

D11.5 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a

repeated criminal records search will not be permitted to continue to perform Work under the Contract within City facilities or on private property.

SCHEDULE OF WORK

D12. COMMENCEMENT

D12.1 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.

D12.2 The Contractor shall not commence any Work on the Site until:

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

(i) evidence that the Contractor is 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;

(ii) evidence of the workers compensation coverage specified in D8;

(iii) evidence of the insurance specified in D9;

(iv) the performance security specified in D10;

(v) the security clearances specified in D11

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

D13. CRITICAL STAGES

D13.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

(a) Shop Drawings:

(i) Acceptable Shop Drawings for all Major Equipment shall be completed within 50 Business Days of the Award of the Contract. Shop Drawing completion shall not be achieved until drawings are reviewed by the Contract Administrator

(b) Delivery:

(i) Delivery of Goods to the Site shall begin no earlier than January 8, 2007 and be completed no later than June 30, 2007;

(ii) The detailed delivery schedule will be based on the Installation Contractor's and the City's requirements and will be coordinated by the Contract Administrator, and included in the Contract Work Schedule. The Goods shall be supplied into the care of the Installation Contractor in accordance with this schedule;

(iii) 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. (See Section E4 Forms)

(c) Satisfactory Installation: The Contractor shall provide support to the Installation Contractor as required to achieve satisfactory installation of All Goods by August 31, 2007

(i) This support shall include (but is not limited to) providing a qualified representative on Site as required to assist the Installation Contractor in achieving satisfactory installation of the Goods supplied under this Contract. Price is requested for 4 2-day Site visits per engine.

(ii) Satisfactory installation 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) Satisfactory Performance and Training: Performance Verification and Training shall begin no earlier than upon commissioning of first engine installation and shall be completed on or before achieving Substantial Performance.

(i) The Contract Administrator will coordinate the performance verification and 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 performance verification and training

(ii) During the performance verification and training period the Contractor shall provide qualified representation on Site as required to assist the Installation Contractor in achieving and demonstrating satisfactory performance of the Goods supplied under this Contract

(iii) Satisfactory performance and training shall be considered complete upon the issuance of Form 103: Certificate of Equipment Satisfactory Performance.

D13.2 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 specified in D15.1(a) will be extended by an equivalent number of Calendar Days.

.

D13.3 All Shop Drawings submitted pursuant to D15.1(a) shall be provided in a single submission.

D14. SUBSTANTIAL PERFORMANCE

D14.1 The Contractor shall achieve Substantial Performance by August 31, 2007.

D14.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.

D14.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a Certificate of Equipment Satisfactory Performance (Form 103) is the date on which Substantial Performance has been achieved.

D15. TOTAL PERFORMANCE

D15.1 The Contractor shall achieve Total Performance by October 12, 2007

D15.2 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 re-inspected.

D15.3 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 (Form 105) is the date on which Total Performance has been achieved.

D16. LIQUIDATED DAMAGES

D16.1 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 Calendar Day for each and every Calendar Day following the day fixed herein for Total Performance during which such failure continues.

D16.2 The amount specified for liquidated damages in D18.1 is based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Total Performance by the day fixed herein for same.

D16.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

MEASUREMENT AND PAYMENT

D17. PAYMENT SCHEDULE

D17.1 Further to GC.9.01 and GC.9.03, payment shall be in accordance with the following payment schedule for each engine:

(a) 1 % upon issuance of Certified Shop Drawings for the entire scope of the Contract.

(b) 64% upon the issuance of Form 100: Certificate of Equipment Delivery and Form 101: Certificate of Instruction.

(c) 10% upon issuance of Form 102: Certificate of Satisfactory Installation

(d) 5% upon receipt of equipment manuals by the Contract Administrator

(e) 5% upon the issuance of Form 103: Certificate of Performance, and upon the completion of training of City staff.

(f) 15% upon the issuance of Form 105 – Certificate of Total Performance.

WARRANTY

D18. WARRANTY

D18.1 Notwithstanding GC.10.01, the standard warranty period shall begin on the date of Total Performance and shall expire either eight thousand seven hundred and sixty (8,760) hours of actual engine operating time at full rated load or one (1) year thereafter, whichever occurs first, unless extended pursuant to D18.2 in which case it shall expire when provided for thereunder.

D18.2 If a defect or deficiency prevents the full and normal use or operation of the Work or any portion thereof, for purposes of calculating the warranty period, time shall be deemed to cease to elapse for the defective or deficient portion, and for any portion of the Work whose use or operation is prevented by such defect or deficiency, as of the date on which the defect or deficiency is observed or the use or operation is prevented and shall begin to run again when the defect or deficiency has been corrected or the Work may be used or operated to the satisfaction of the Contract Administrator.

D18.3 Notwithstanding GC.10.01, GC.10.02, D18.1, and D18.2 if any law of Manitoba or of the jurisdiction in which the Work was manufactured requires, or if the manufacturer provides, a longer warranty period or a warranty which is more extensive in its nature, then the provisions of such law or manufacturer’s warranty shall apply.

D18.4 The terms in this section shall also apply to any extended warranty that may be included in the Contract.

D18.5 A Certificate of Acceptance (Form 106) will be issued to confirm expiry of the warranty or extended warranty.

FORM H1: PERFORMANCE BOND
(See D10)

KNOW ALL MEN BY THESE PRESENTS THAT

_____

(hereinafter called the "Principal"), and

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

_____

_____ dollars ($_____.____)

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

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

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 730-2005

SUPPLY, DELIVERY, SUPERVISION OF THE INSTALLATION AND COMMISSIONING OF NATURAL GAS ENGINE DRIVES FOR MACLEAN PUMPING STATION

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)
(See D10)

(Date)

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

RE: PERFORMANCE SECURITY – BID OPPORTUNITY NO. 730-2005

SUPPLY, DELIVERY, SUPERVISION OF THE INSTALLATION AND COMMISSIONING OF NATURAL GAS ENGINE DRIVES FOR MACLEAN PUMPING STATION

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)

PART E - SPECIFICATIONS

GENERAL

E1. GENERAL

E1.1.1 In this section, the term Contractor shall also be understood to mean the Manufacturer of the engine(s) or his/her authorized representative.

E1.2 Scope – Contractor to:

E1.2.1 Supply and delivery of two (2) standard emission natural gas engines and associated equipment required for direct connection to existing centrifugal municipal water pumps.

E1.2.2 Provide authorized Engine Manufacturer's representative to assist in the testing and commissioning of the engine drives. Installation, testing and commissioning of the gas engine drives shall be performed by the Installation Contractor under the separate installation and construction contract.

E1.2.3 Provide all specified factory and field testing including provision of reporting.

E1.2.4 Provide all specified training.

E1.2.5 Provide complete submittal and operations and maintenance documentation with specific identification of equipment provided for this project.

E1.2.6 Supply spare parts as identified.

E1.3 Applicable Codes Standards

E1.3.1 International Standards Organization (ISO) 3046-1:2002 Reciprocating Internal Combustion Engines.

E1.3.2 Canadian Standards Association (CSA) Natural gas and Propane Installation Code, B149.1-05.

E1.3.3 CSA Code for the Field Approval of Fuel Related Components on Appliances and Equipment, B149.3-00 or latest edition...

E1.3.4 CSA Canadian Electrical Code, C22.1-06.

E1.3.5 CSA Boiler, Pressure Vessel, and Pressure Piping Code CSA B51-03

E1.3.6 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, ASME B31 Section VIII

E1.3.7 ASME Chemical Plant and Petroleum Refinery Piping, B31.3-2004.

E1.4 Submittal Data

E1.4.1 In accordance with GC.4.04 Shop Drawings for all equipment to be supplied shall be submitted to the Contract Administrator within 50 Business Days of award of Contract for review prior to the Contractor manufacturing the equipment. Provide six copies to the Contract Administrator.

E1.4.2 Anchor bolt details and templates shall be submitted.

E1.4.3 Torsional Analysis report shall be submitted.

E1.4.4 Engine fuel efficiency data for the HP / RPM data as listed in the specification.

E1.5 Operating and Maintenance Data

E1.5.1 Contractor shall provide seven original sets of manuals (in English) for each type of equipment. These shall be submitted to the Contract Administrator for review. The Contractor (Manufacturer) shall provide these manuals sixty (60) days in advance before commencement of equipment operation.

E1.5.2 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.

E1.5.3 In addition to information called for in the Specifications, include the following;

(a) 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.

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

(c) Table of contents.

(d) Reviewed shop drawings of all equipment.

(e) Certified factory test results in accordance with this Specification.

(f) Full description of all systems, operation and control.

(g) Names, addresses and telephone numbers of all major sub-contractors and suppliers.

(h) Detailed Specifications and Operating and Maintenance instructions for all items of equipment provided including a preventative maintenance program.

(i) 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.

(j) Illustrated parts books and list of all assemblies, sub-assemblies and components.

(k) Test procedures for all electronic and electrical circuits.

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

(m) Field test results (to be provided upon test completion).

(n) A Digital Video Disk (DVD) of training session held in Winnipeg (after completion of training).

E1.5.4 The Contractor shall modify and update the manual as required by the Contract Administrator. When accepted, five (5) additional copies shall be provided by the Contractor to the Contract Administrator thirty (30) days in advance of equipment start-up.

E1.5.5 The Contract shall not be considered complete until the above manuals have been completed and submitted, to the satisfaction of the Contract Administrator.

E1.6 Background

E1.6.1 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 (five) 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.

E1.6.2 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.

E1.6.3 The two Waukesha engines are direct coupled to DeLaval centrifugal pumps. Pneumatic actuators are used to engage Twin Disc clutches (Model EH224 P00, Serial nos. 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.

E1.6.4 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.

E1.6.5 There is an actuated discharge valve on the outlet of each pump. The discharge valve is a two position type, operated as either fully opened or fully 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.

E1.6.6 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.

E1.6.7 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 and the engine restarted at any time.

E1.7 Available Information

E1.7.1 The following available information is provided with the Bid Opportunity in the Appendix.

(a) MacLean pump curve.

(b) MacLean pump construction data

(c) Twin Disc clutch information (SP-321P)

(d) Existing base plate drawing

E1.7.2 Access to the MacLean Site can be arranged with a minimum 48 hours notice with the Contract Administrator. The Bidder will not be allowed to take photographs. Upon prior

request, the City will arrange to take photographs for the Bidder, but reserves the right to limit the content of the photographs for security reasons.

E1.8 Design Conditions

E1.8.1 The design conditions are:

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

E1.8.2 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

E2. GOODS

E2.1 Pump Drive Package

E2.1.1 The pump driver package is to consist of an engine, clutch, drive coupling, engine cooling system, fuel gas train, engine silencers, flexible connections, monolithic steel engine and pump base, controls and indication, crankcase emission filtering system and other features as specified.

E2.1.2 The supplier is to be responsible for the assembly of the engine and all attached equipment including the clutch. (The Installation Contractor will couple the unit to the existing pump).

E2.2 Engine

E2.2.1 The pump driver is to be a standard emissions 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 and alternative pricing is requested for suitable engine of each type. 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.

E2.2.2 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.

E2.2.3 Minimum engine power requirement at speed shown is:

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

MacLean operating RPM range: 1000-1150

E2.2.4 Acceptable engine suppliers are Caterpillar or Waukesha.

E2.3 Fuel Gas Train

E2.3.1 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).

E2.3.2 The fuel train is to be provided with the engine and will include both engine mounted and unmounted equipment supplied for field connection by others.

E2.3.3 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 zero governor type regulator.

(j) An automatic speed governor.

(k) A vacuum switch and low oil pressure switch.

(l) Overcrank protection.

(m) The existing accumulator will be maintained.

E2.3.4 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. 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 500mm (18”) above the floor by the Contractor.

E2.3.5 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 be 33.7kPa (4.9psig).

E2.4 Engine Cooling

E2.4.1 The engine cooling system and all components listed herein will be provided by the Contractor. 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.

E2.4.2 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.

E2.4.3 The engine coolant is to be a 50/50% mixture of water/ethylene glycol specifically formulated for use in natural gas fired engines.

E2.4.4 The engine jacket coolant system is to be a closed loop design with provision for filling, expansion and venting. An engine mounted surge tank, or remote mounted surge 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.

E2.4.5 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).

E2.4.6 Auxiliary coolant pumps for other cooling circuits are to be engine driven.

E2.4.7 The cooling system is to be designed for a minimum 172kPa (25psi) static pressure.

E2.4.8 An internal engine mechanical thermostat is to regulate engine coolant temperatures separately from external cooling systems until the normal operating temperature is reached.

E2.5 Heat Exchanger

E2.5.1 Heat exchangers and related components are to be supplied by Contractor. 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).

E2.5.2 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.

E2.5.3 The heat exchanger is to be designed with the following requirements:

(a) Most efficient water usage.

(b) Minimum 22ºC (40ºF) 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 (40 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 (7.0ft/s) or less as recommended by the heat exchanger manufacture to minimize erosion of the tube bends.

E2.5.4 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 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.

E2.6 Remote Radiator Option

E2.6.1 Provide as a separate component, an optional price for the supply of remote mounted radiators for each new engine system:

(a) The remote mounted radiator used as part of the engine cooling circuit will be installed outside the building.

(b) The radiator is to be provided as a complete unit with mounting legs, radiator core guard/hail guard, thermostatic control, and expansion tank with sight glass and a Murphy low level switch.

(c) The radiator cooling capacity is to be sized to reject 110% of the engine full load cooling requirement at an outdoor air temperature of 25ºC (77ºF). A fouling factor equal to 20% of the load is to be included in system sizing.

(d) The radiator is to be designed for operation at ambient temperatures between -40 and 40ºC (-40 to 104ºF).

(e) The radiator is to be designed for vertical up airflow. Airflow is to be provided by two or more fans as required, Fans are to be direct drive with variable pitch blades or other means to provide capacity control. Fan motors are to be 575VAC three phase. Fan guards are to be provided on each fan.

(f) The radiator is to provide a maximum engine coolant pressure drop of 34kPa (5psi) at full engine coolant flow.

(g) The radiator core is to be designed for a minimum pressure of 1034kPa (150 psi). The core is to be factory pressure tested before shipping.

(h) Piping connections to the radiator are to be raised face flanges. Minimum size 150mm (6”).

(i) Provide sound pressure level readings in Dba at set distance from radiator.

E2.7 Engine Jacket Heater

E2.7.1 Two electric jacket water heater(s) are to be provided by Contractor on the engine to maintain the engine coolant at a constant temperature of 32ºC (90ºF) when the engine is off.

E2.7.2 The heaters are to be thermostatically controlled.

E2.7.3 Heaters are to be CSA approved, 120VAC single phase.

E2.7.4 Hoses used to connect the heaters to the engine are to be industrial grade and selected for the temperature and operating conditions.

E2.7.5 Manual shut off valves are to be provided to permit isolation of the heaters for servicing.

E2.8 Drive Assembly

E2.8.1 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 Contractor and:

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

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

(c) Separate pricing is requested for the clutch and installation, and for supply of the coupling.

E2.8.2 The pumps are monitored for reverse spin.

E2.8.3 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.

E2.8.4 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.

(e) 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.

(f) The clutch is to be selected to permit a clutch engagement period of between 1 to 2 seconds. A faster engagement will not be acceptable.

(g) The selection of the clutch is to be coordinated with the required engine cool down period.

(h) The clutch is to be as manufactured by Twin Disc.

E2.8.5 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:

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

(b) Coupling bolts shall be chrome-plated or Stainless Steel to prevent corrosion.

(c) Exposed surfaces of non-stainless parts shall be impregnated with a rust inhibiting material.

(d) Coupling shall be rated for a minimum of 800HP @ 1200RPM.

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

(f) Acceptable Product: Metastream “T” Series, Model TSCS-1400-0077-2540 (10” standard shaft separation) or approved equal.

(g) Closed type coupling guard to provide finger safe protection from rotating parts.

E2.9 Lubrication System

E2.9.1 The lubricating system provided by the Contractor 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 cooling system.

E2.9.2 The oil pump is to be engine driven and is to be a positive displacement pump.

E2.9.3 The 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.

E2.9.4 Disposable filter elements are to be used.

E2.9.5 The oil sump is to be provided with a valved drain to facilitate oil changes.

E2.9.6 Provisions are to be made to permit the engine oil levels to be checked with the engine operating.

E2.9.7 A differential pressure indicator is to be provided by the Contractor on the oil filter element to identify when the oil filter requires changing.

E2.9.8 A Murphy low oil level shutdown switch is to be provided by the Contractor.

E2.9.9 Low Oil Pressure shutdown switch is to be provided by the Contractor.

E2.9.10 Proper lubrication shall be provided at all times for any turbocharger(s) including during an emergency engine shutdown.

E2.10 Pre-Lube Pump

E2.10.1 A pre-lubrication lubrication pump system is to be provided and installed by the Contractor to circulate engine lubricating oil when the engine is off. The pump is to be electric driven, positive displacement, with an internal pressure relief valve set to suit acceptable engine oil pressures.

E2.10.2 The pump is to be 120VAC, single phase.

E2.10.3 The pump is to be pre piped and mounted.

E2.10.4 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 Contractor.

E2.10.5 The Pump is to be cycled on and off. The pump on and off times are to be independently adjustable from 1-60 minutes.

E2.10.6 Provide low oil pressure switch (form C contacts, 120VAC rated) to indicate failed pre-lube pump (wired in series with pump control)

E2.10.7 Pump control is to include manual “Maintenance Mode” disable and ON override switches. Status of these switches is to be monitored by the SCADA system through form C contacts, 120VAC rated contacts.

E2.11 Electric Starting and Charging System

E2.11.1 Contractor is to provide an electronic 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.

E2.11.2 Both starters are to normally operate. A single starter is to be able to start the engine.

E2.11.3 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.

E2.11.4 A steel frame battery stand with a painted 19mm (¾") thick, plywood top is to be provided. Acid resistant epoxy paint to be used for both the stand and top.

E2.11.5 An automatic battery charger is to be provided (120VAC to 24VDC). The charger is to have a manual high charge capability and is to have 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 low voltage alarm contacts for connection to the pumping station SCADA system. 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. Charger supply power by others.

E2.11.6 Power cables from the charger to the battery and the battery to the engine are to be provided. They are to be sized to suit 125% of the maximum requirements of the electrical circuits they feed.

E2.12 Air Supply

E2.12.1 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 round, piped air supply. A pressure differential gauge is to indicate the requirement for air filter replacement.

E2.12.2 Any turbocharger(s) are to be axial turbine type, driven by engine exhaust gases and direct connected to a compressor supplying engine combustion air.

E2.12.3 An after cooler/intercooler is to be provided by Contractor designed to use 54°C (130°F) coolant.

E2.13 Crankcase Ventilation System

E2.13.1 An external crankcase emission filtering system(s) is to be provided on the engine by Contractor. The system is to filter and clean the crankcase emissions to allow the gases to be returned to the inlet of the air cleaner.

E2.13.2 The system is to use replaceable filter elements housed in a painted steel housing with quick access covers.

E2.13.3 A differential pressure gauge is to be installed and connected to indicate the pressure drop across the system filter and used to determine the requirement for replacement. Provide dry contacts for "Service" and "Alarm" to be connected to SCADA system.

E2.13.4 Collected condensate is to be piped to a floor mounted, 4 litre (0.9 Imperial gallon) plastic container for disposal.

E2.13.5 The filters are to be installed to provide ease of access for replacement of filters.

E2.13.6 The filter system is to be the Nelson EcoVent Recirculator or approved equal.

E2.14 Engine Silencers

E2.14.1 Contractor shall provide low pressure drop engine exhaust silencer with flanged inlet and outlet and end in, end out orientation. Flange sizes are to be 250mm (10"). Construction is to be 100% type 304 stainless steel.

E2.14.2 Sound attenuation is to be 15-25 dBA reduction for industrial grade silencers and 20-25 dBA reduction for residential grade silencers.

E2.14.3 Pressure drop is to be below 1kPa (4" w.c.)

E2.14.4 Supply silencers as indicated:

(a) Engines #22 and #26 (MacLean): Industrial grade.

E2.15 Engine Controls

E2.15.1 A stand alone microprocessor engine control system is to be provided by Contractor to control all engine functions including:

(a) Speed governing.

(b) Spark timing control and detonation protection.

(c) Start/stop including emergency stop.

(d) Engine cool down.

(e) Engine safety including overspeed, low oil level, high coolant temperature and control malfunction.

(f) 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.

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

E2.15.2 The system is to accept external control inputs including START/STOP and speed reference signal.

E2.15.3 An electronic governor is to be provided by Contractor. 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.

E2.15.4 Controls and system power are to be 24VDC.

E2.15.5 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.

E2.15.6 The system is to maintain a history of all engine faults and shutdowns. Contractor 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.

E2.15.7 The engine control system is to include a panel providing local engine control, engine status, and indication of alarms.

E2.15.8 The control system is to permit communications with the pump station Supervisory Control and Data Acquisition (SCADA) system. All necessary interface software and hardware is to be provided.

E2.15.9 All discrete monitoring points shall be a minimum of 2Amp, form C contacts, 120VAC rated.

E2.15.10 Temperature transmitters shall be Rosemount 644HAK6XAM5J6F6/0068N21C30A030W38E6V1 complete with Liquid Crystal Display (LCD) local display, thermal well, 100Ω Platinum Resistive Temperature Device (RTD), or approved equal.

E2.15.11 Pressure transmitters shall be Rosemount 3051S1TG2A2A11A1AK5M5/0306RT12AA11 complete with LCD local display and block & bleed instrument manifold or approved equal.

E2.15.12 Differential pressure transmitters shall be Rosemount 3051S1CD2A2A11A1AK6M5/0305RC32B11B4 complete with LCD local display and 3 valve instrument manifold or approved equal.

E2.16 Local Indication

E2.16.1 Local indication of the following engine conditions is to be provided by Contractor 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) Jacket water temperature.

(c) Tachometer.

(d) Coolant level.

(e) Oil filter differential pressure.

(f) Air cleaner differential pressure.

(g) Inlet manifold air temperature.

(h) Inlet manifold air pressure.

(i) Service hour meter.

(j) Crankcase emissions filtering differential pressure.

(k) Exhaust gas temperature.

E2.16.2 Gauges are to be suitable for media sensed or equipped with process seals.

E2.17 Monolithic Steel Base

E2.17.1 The following information is included in the Appendix.

(a) MacLean steel base drawing for original pump and engine

E2.17.2 A steel base to be provided by Contractor 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.

E2.17.3 The base and mounts are to be designed to resist deflection, maintain alignment and minimize resonant vibrations.

E2.17.4 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.

E2.17.5 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.

E2.17.6 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.

E2.17.7 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.

E2.18 External Connections

E2.18.1 All mechanical connections to external systems are to be threaded or flanged and shall use proper sealant for the products in use.

E2.18.2 Flexible connectors are to be supplied with the engine by Contractor for natural gas, exhaust system, engine cooling water jacket inlet and outlet, aftercooler and or/inlet cooler inlet and outlet and combustion air piping.

E2.18.3 Flexible connections are to be selected for their specific application of temperature, pressure and material.

E2.19 Explosion Protection

E2.19.1 The crankcase is to be protected by the installation of crankcase mounted explosion vents.

E2.19.2 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.

E2.20 Painting and Protective Coatings

E2.20.1 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.

E2.20.2 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.

E2.20.3 All ferrous surfaces are to be coated before the blasted surfaces deteriorate.

E2.20.4 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 Installation Contractor. The touch-up paint to be used shall be supplied by the Contractor as per the Contractor's recommendations.

E2.20.5 The Contractor shall submit with shop drawings, specifications defining the paints that are proposed for use, to the Contract Administrator for review.

E2.20.6 The Contract Administrator shall advise the finishing colours required on the equipment prior to manufacture.

E2.21 Engine Testing – General

E2.21.1 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. The Contractor is to perform all field testing.

E2.21.2 Provide minimum of 4 weeks advance notice of the starting date of factory testing to the Contract Administrator.

E2.21.3 Seven certified copies of final test reports are to be provided within one (1) week of successful testing.

E2.21.4 Tests which are aborted due to equipment failure or other causes are to be repeated in full.

E2.21.5 Field testing is not to proceed until the installation and mounting has been fully reviewed by the Contractor's representative and any identified deficiencies corrected.

E2.21.6 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.

E2.21.7 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**
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.	**X**	**X**

E2.21.8 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.

E2.22 Factory Testing

E2.22.1 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 Contractor'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 to cool 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.

E2.22.2 An analysis of engine lubricating oil is to be provided by Contractor after factory testing. Engine oil and filter are to be changed prior to shipment.

E2.23 Field Testing

E2.23.1 Allow 4 days on Site for installation inspection and testing of each of the two (2) engines. Provide additional time if required due to problems with the engine or supplied equipment.

E2.23.2 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 Contractor's representative. Coordination with station operators to permit operation of the pump will be needed.

E2.23.3 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 Contractor supplied engine management (shut down control systems) disassembled for shipping.

E2.24 Spare Parts

E2.24.1 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 emissions filters.

E2.25 Special Tools

E2.25.1 Contractor 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.

E2.26 Additional Monitoring

E2.26.1 Contractor shall supply and at appropriate time, install the following instrumentation wired to a terminal cabinet for additional engine and pump monitoring and supervision, at no extra cost. All wire ends and terminals to be identified using oil and heat resistant tags (self laminating type).

I.D.	Type	Tag I.D.	Description	Location
S25	AI	PCG043TTBN	Clutch Outboard Bearing Temp	Engine
S10	AI	PCG043PAL1	Engine Oil Pressure	Engine
S6	DI	PCG043LAL1	Engine Low Water Level	Engine
S11	AI	PCG043PS2	Pre-Lube Pressure	Engine
S16	AO	PCG043SC	Speed Control	Engine
S17	AI	PCG043ST2	Engine Speed	Engine
S18	DI	PCG043MM1	Engine Run Status	Engine
P5	AI	PCG043TT5	Engine Oil Temp RTD	Engine
P6	AI	PCG043TT6	Engine Water Temp RTD	Engine
P7	AI	PCG043XT1	Engine Vibration	Engine
P28	DI	PCG043PAL0	Engine Oil Pressure Low	Engine
P39	DO	PEG043VD1	PG043FCV1 Clutch Open	Engine
P40	DO	PEG043VD2	PG043FCV2 Clutch Close	Engine
P51	DI	PCG043EAL1	Battery Condition Fault	Engine
P52	DI	PCG043EAL2	Battery Voltage Low	Engine

E2.27 Torsional Analysis

E2.27.1 Contractor 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.

(a) 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.

E2.28 Extended Warranty

E2.28.1 The Contractor shall offer, and show any extra cost to extend the standard Contractor's warranty to cover the following total period:

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

b) 5 years or 12,000 full load hours, whichever comes first.

E3. DELIVERY

E3.1 Delivery

E3.1.1 Goods shall be delivered, f.o.b. destination, freight prepaid, to:

Mclean Pumping Station
875 Lagimodiere Blvd.
Winnipeg, MB

E3.1.2 The Contractor shall ensure the engines and all accessories are properly packaged and loaded to prevent weather or transport damage.

E3.1.3 The engines are to be prepared for shipment and storage at ambient outdoor design conditions for Winnipeg, including below freezing temperatures.

E3.2 Engine Installation

E3.2.1 Contractor shall provide technical assistance to the Installing 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.

E3.3 Clutch Installation

E3.3.1 The Contractor is to install the clutch prior to shipment; clutch installation and alignment to be in accordance with clutch and engine manufacturer's guidelines.

E3.4 Training

E3.4.1 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.

E3.4.2 The Contractor shall provide qualified instructor(s) as well as the necessary course materials approved by the Engine Manufacturer. Training for the equipment shall be conducted prior to completion of the project at the City of Winnipeg Site.

E3.4.3 The training shall be provided by the Contractor 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.

E3.4.4 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

E4. FORMS

E4.1 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

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 REFERRED 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 _____

Appendix A

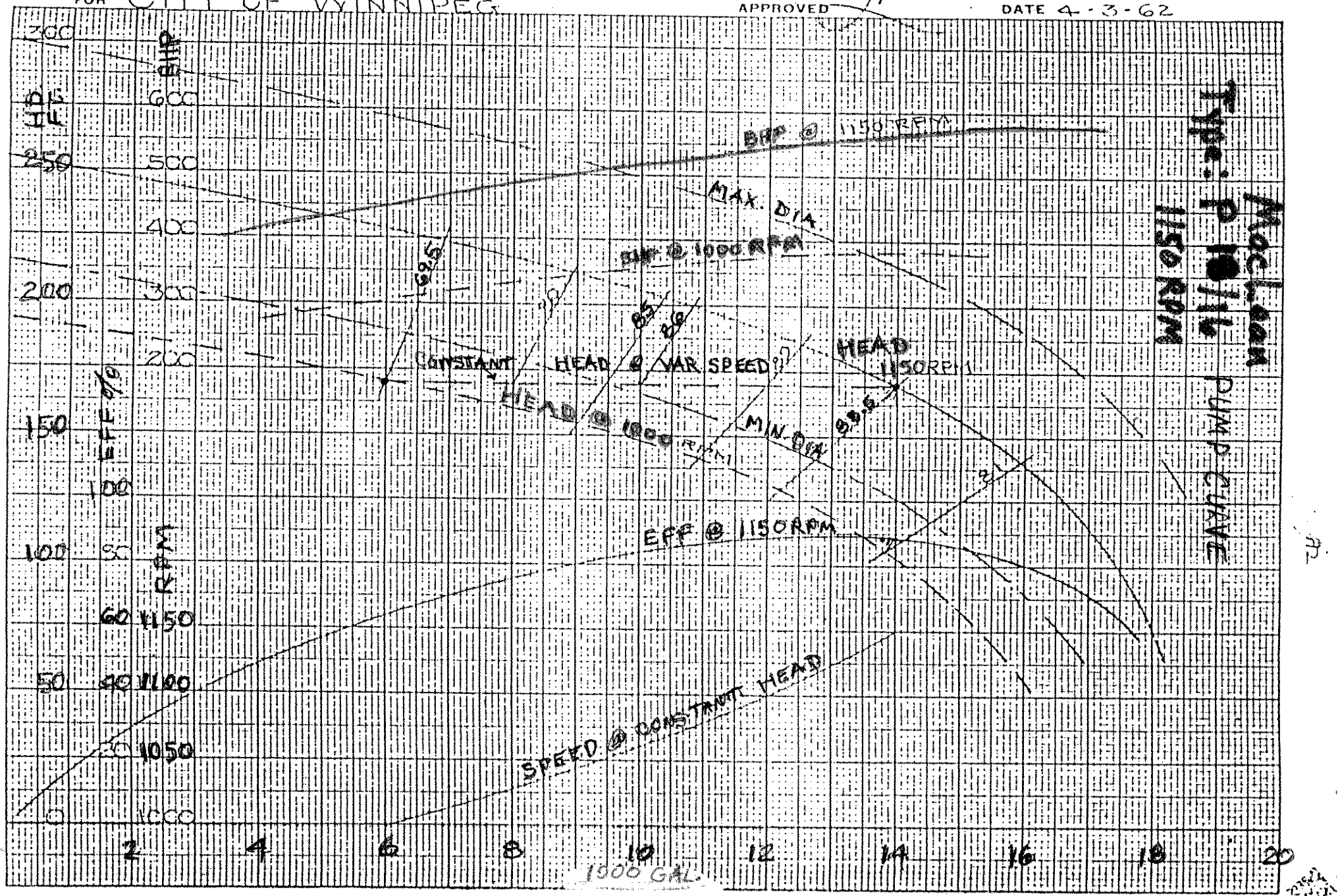
MacLean Pump Curve

(1 Sheet Follows)

FOR 5/16 CENTRIFUGAL PUMP TYPE MACLEAN P18/16 SPEED 1150 R. P.

Curves are approximate and pump is guaranteed at indicated operating point only. Capacity, head and efficiency guarantees are based on shop test.
Pump will handle clear water at a temperature of degrees F. with ~~a dynamic~~ suction TYPE PRESSURE of flooded

FOR CITY OF WINNIPEG APPROVED DATE 4-3-62



Appendix B

MacLean Pump Construction Data

(5 Sheets Follow)

1/5

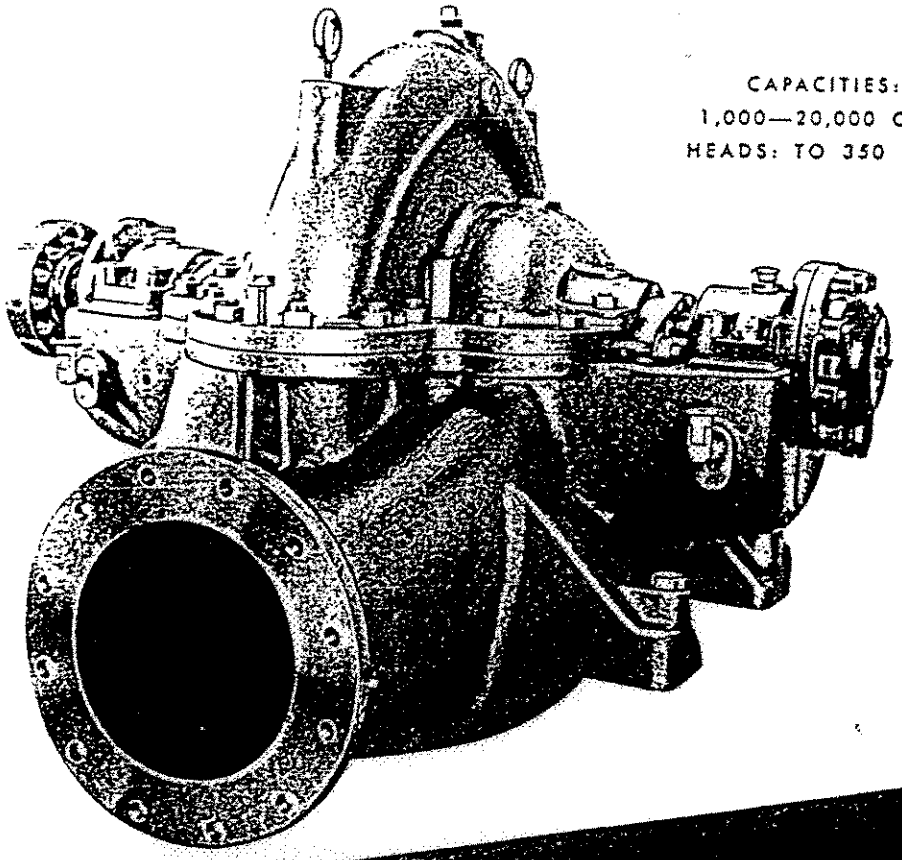
BULLETIN 1004

DE LAVAL

SINGLE STAGE DOUBLE SUCTION

Types L, M and P

CENTRIFUGAL PUMPS



CAPACITIES:
1,000—20,000 GPM
HEADS: TO 350 FEET

DE LAVAL STEAM TURBINE COMPANY • TRENTON 2, NEW JERSEY

DE LAVAL TURBINE CANADA LTD.

PUMP SIZE AND TYPE	De Laval 18/16" Horizontal, Single Stage Split Casing, Bottom Suction, Side Discharge Double Volute Centrifugal Pump with Fabricated Steel Bedplate for Pump and Driver.

MATERIALS

PUMP CASING	Cast Iron ASTM A48 Class 30
IMPELLER	Bronze ASTM B143 Class 1A
IMPELLER RINGS	Bronze ASTM B147-49-(8A)
CASE RINGS	Bronze ASTM B143 Class 1A
SHAFT	Open Hearth Machinery Steel ASTM A107 Grade 1045 or ASTM A306 Grade 75
SHAFT SLEEVES	Chrome Plated Bronze
BEARINGS	Steel Shell Babbitt Lined

DIMENSIONS

1. Bearings Couplings	3-1/2 x 5" 700 HP, 1180 RPM
2. Wearing Rings	Double Labyrinth Type
3. Stuffing Boxes 6 - Rings	4" I.D. 5-1/2" O.D. 3/4" square packing
4. Shaft Diameter at Impeller	4"
5. Bearing Load	23 lbs. per square inch projected area
6. Shaft Size at Bearing Bearing Center Distance	3-1/2" 48-1/2"
7. Weight Shaft and Impeller Assembly	800 lbs.
Weight - Complete Pump	7,000 lbs.

DE LAVAL SINGLE STAGE DOUBLE SUCTION CENTRI

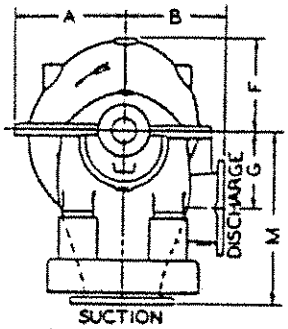
TYPES
L, M and P
offer sustained efficiencies over long years of service

De Laval Types L, M and P horizontally split case centrifugal pumps are built to stay on the job. Their high efficiencies are a result of more than a half century of experience in pump manufacture and continuous research. Initial efficiencies are maintained over long periods of operation with a minimum of maintenance by De Laval's widely accepted double-labyrinth casing and impeller wearing rings. Other features described in the chart at the right also contribute to long dependable life.

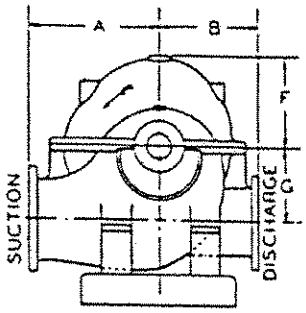
De Laval L, M and P pumps are rugged in construction. They are easily disassembled. All parts can be inspected without disturbing the suction and discharge pipe connections. The materials used are selected to resist corrosion and wear. Renewal parts can be quickly installed because all parts are produced to limit gages for complete interchangeability.

FEATURE	CONSTRUCTION
Pump Casing	Divided on the horizontal centerline. discharge nozzles, as well as suppor cast integral with the lower half casi own foundry of Meehanite metal.
Impeller	Vanes and shrouds forming the enclos of the double suction one-piece type i smooth finished inside and out. Impeller is accurately balanced.
Double Labyrinth Type Wearing Rings	Casing rings are securely held in place a tongue and groove joint in the pump Impeller rings threaded opposite to rot screwed to the outside diameter of the Intermeshing grooves of the double laby and number of abrupt turns reduce inte
Shaft	Amply proportioned, of high tensile all Accurately machined for interchangeabi of both shaft and parts upon it.
Shaft Sleeve	Threaded type, screwed to shaft and abu impeller hub, completely covers shaft a a bearing surface for the packing.
Bearings	Radial bearings are ring-oiled, split-sleev Liberal size shells are steel-backed babbi bearing on the outboard end locates the

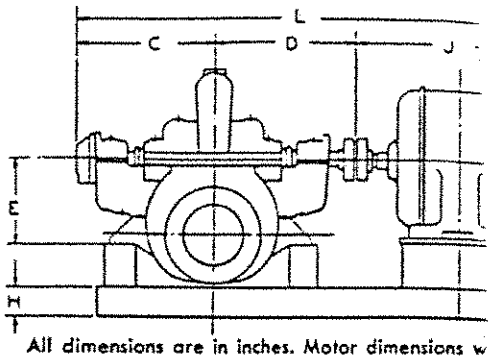
DIMENSIONS



END VIEW A



END VIEW B



All dimensions are in inches. Motor dimensions w
depending on make and frame.

Bottom Suction—Side Discharge (End View A)

TYPE	SIZE	SUCT.	DISCH.	A	B	C	D	E	F	G	H	J	K	L
L	16/14	16	14	19⅜	20	26⅞	28¾	20	15¼	14	5	50⅜	31	106¼
	18/16	18	16	22½	20	26⅞	28¾	20	18	14	5	56⅜	32¼	112¼
M	12/10	12	10	20⅜	19	27⅛	30	17	16⅞	14	5	50⅜	28½	107¾
	14/12	14	12	22⅛	20	27⅛	30	17	17⅞	15	5	56⅜	31	113¾
	16/14	16	14	23½	21	27⅛	30	17	18⅞	16	5	56⅛	33	113¼
P	12/10	12	10	20½	24	33⅛	37	20	17	11	6	54⅝	27	124¾
	12/10 D	12	10	30	26	30¾	36¾	19	22½	19	6	57⅛	34½	125⅛
	14/12	14	12	22	25	30¾	36¾	22	18	14	6	59⅛	31	126⅛
	16/14 D	16	14	31	28	30¾	36¾	22	22	21	6	63⅜	39	130⅞
	18/16	18	16	25⅝	30	33⅛	37	24	20⅝	19	6	63⅜	39	133½
	18/16 D	18	16	34½	30	30¾	36¾	24	25	24	6	72¾	43¼	139⅞
	20/18	20	18	25	24	30¾	36¾	20	20	16	6	56⅛	36	123⅜
	24/20	24	20	27	24	30¾	36¾	22	21	19	6	59⅛	42¼	126⅝

Side Suction—Side Discharge (End View B)

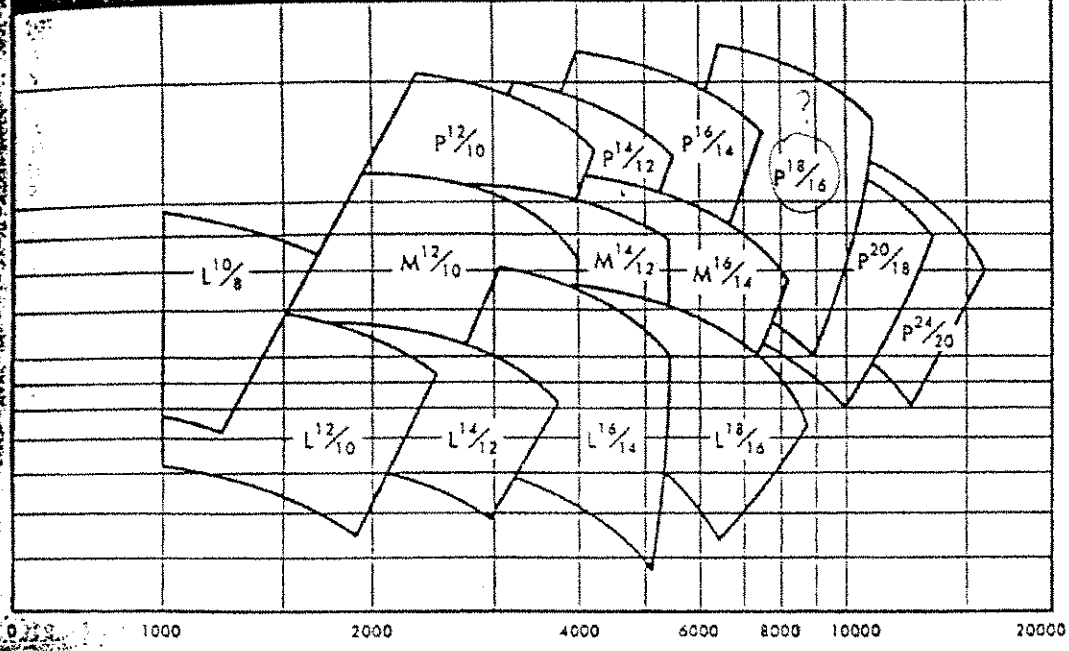
TYPE	SIZE	SUCT.	DISCH.	A	B	C	D	E	F	G	H	J	K	
L	10/8 D	10	8	23	18	24¾	26⅛	21½	16	12½	5	50⅜	28	1C
	12/10	12	10	20	17	24¾	26⅛	21½	13½	9¾	5	53⅜	28	1C
	14/12	14	12	22	20	24¾	26⅛	21½	14⅜	10¾	5	56½	28	1C
	16/14	16	14	24	20	26⅞	28¾	30	15¼	14	5	50⅜	36½	1C
	18/16	18	16	30	20	26⅞	28¾	30	18	15	5	56⅛	36½	11
M	12/10	12	10	25	19	27⅛	30	17	16⅞	14	5	50⅜	30	10
	12/10 D	12	10	30	26	27⅛	30	17	18¼	17½	5	57⅝	33	11
	14/12	14	12	26	20	27⅛	30	17	17⅞	15	5	56⅜	32	11
	16/14	16	14	27	21	27⅛	30	17	18⅞	16	5	56⅛	34	113
P	12/10	12	10	27	23	33⅛	37	25¼	17½	15½	6	54⅝	32	124
	12/10 D	12	10	30	26	30¾	36¾	19	22½	19	6	57⅛	36	125
	14/12	14	12	29	24	30¾	36¾	25	18½	16	6	59⅛	33	126
	16/14	16	14	32	28	33⅛	37	28	19¼	16	6	63⅜	35	133½
	16/14 D	16	14	34	28	30¾	36¾	22	21¾	21	6	63⅜	39	130
	18/16	18	16	35	30	30¾	36¾	21½	20½	19	6	72⅜	39½	139
	20/18	20	18	32	24	30¾	36¾	20	19¾	16	6	56⅛	38	123½
	24/20	24	20	33	24	30¾	36¾	22	20¾	19	8	59⅛	45½	126½

DE LAVAL Steam Turbine Company
Trenton 2, New Jersey
District offices and representatives in principal cities of the United States, Canada and abroad

PRINTED IN U.S.A.

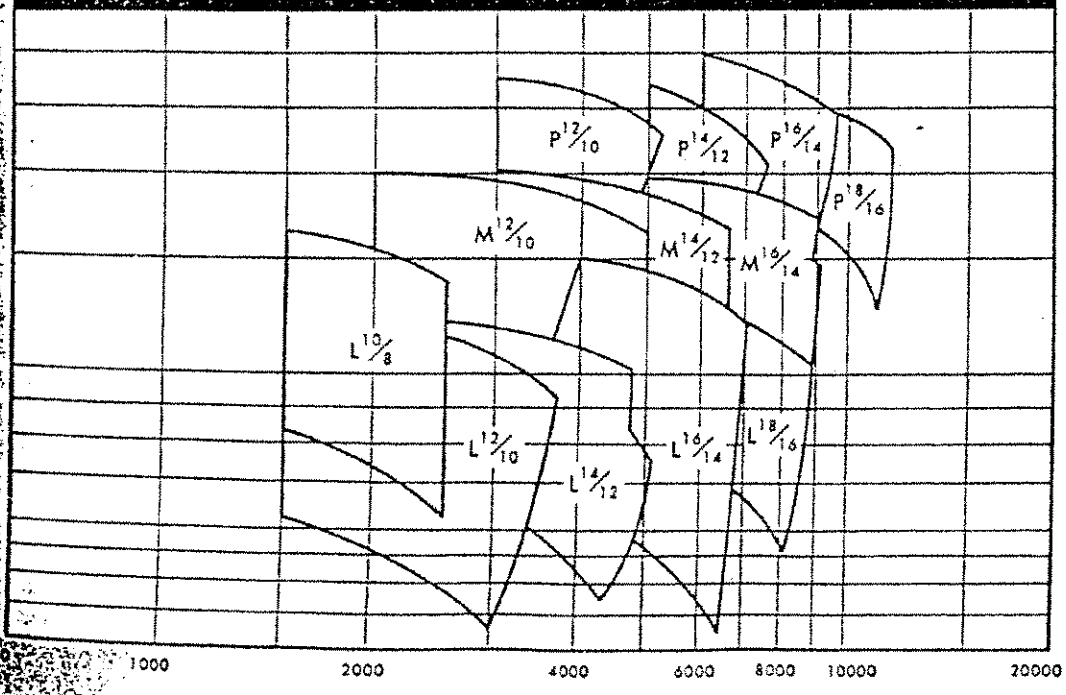
PERFORMANCE DATA

CAPACITY AND HEAD RANGE



GPM AT 885 RPM

CAPACITY AND HEAD RANGE



GPM AT 1175 RPM

Appendix C

Twin Disc Clutch Information (SP-321P)

(2 Sheets Follow)

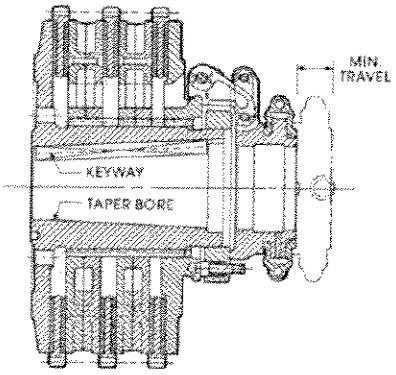
TWIN DISC

BULLETIN 339-H

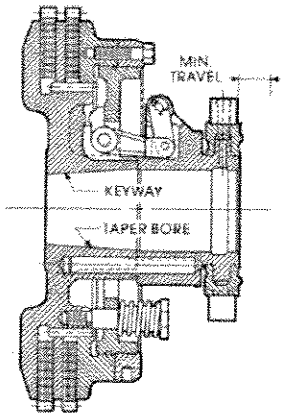
1/2

Dry Clutches

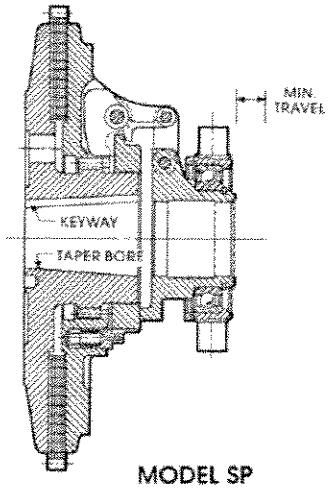
Capacity up to 1667 hp



MODEL IBF
STANDARD COLLAR



MODEL SL
SPRING APPLY



MODEL SP
BALL-BEARING COLLAR

Specifications

Clutch Model	Assembly No.		Application Duty Classification				Maximum Safe Operating Speed (RPM)			
			Class I	Clutch Maximum HP Rating (See Note 2)			Solid Plates		Split Plates	
	Bronze Collar	Ball Bearing Collar	Max. Input Torque Lb. Ft.	Class II	Class III	Class IV	Cast Iron Dr. Ring	Nodular Iron Dr. Ring	Cast Iron Dr. Ring	Nodular Iron Dr. Ring
C-106	XA5059	XA5059A	159	40	27	20	3500	3500	3500	3500
C-107	XA5080	XA5080A	175	54	36	27	3200	3200	3200	3200
C-108	XA5079	XA5079B	230	61	41	31	3100	3100	3050	3100
C-110	X7876	XA7876A	328	96	64	48	3100	3930	2650	3500
C-111	X7875	X7875A	387	124	82	62	2850	3600	2200	3200
SP-111	XA6527	XA6527F	455	124	82	62	2850	3600	2200	3200
SP-211	X9688	X9688B	909	247	165	124	2850	3500	2200	3160
SP-311 [316"]	- - -	XA7569	1620	371	247	186	NA	3000	NA	NA
SP-114	X9644	X9644A	810	186	125	94	2400	3000	1950	2750
SP-214 [216"]	X9586	X9586A	1620	376	251	188	2500	3000	1950	2750
SP-214 [316"]	X9586B	X9586C	1620	376	251	188	2500	3000	1950	2750
SP-314	X9590	X9590A	2430	564	376	282	2500	3000	1920	2700
SP-218	XA7197	XA7197A	4000	622	415	311	1950	NA	1550	NA
SP-318	X9674	X9674A	6000	933	622	467	2050	2350	1500	2100
SP-321	X9697	NA	6730	1270	847	635	1800	—	1400	—
IBF-214	X9756	NA	1620	395	264	197	NR	2400	NA	NA
IBF-314	XA7150	NA	3040	741	494	371	NR	2400	NA	NR
IBF-318	X9934	NA	7500	1224	816	612	NR	2200	NA	NR
IBF-321	X9935	NA	8400	1667	1111	834	NR	2200	NA	NR
SL-111	X7932AP	NA	350	124	82	62	2625	2625	2200	2625
SL-211	X8172F	NA	525	247	165	124	2750	2750	2200	2750
SL-214	X8180P	NA	1000	376	251	188	1800	1800	1800	1800

NOTES: 1. NA (Not available). **NR** (Not recommended).

2. Horsepower and torque ratings may be increased by specifying optional sintered iron type clutch plates. Available 8" through 21" sizes.

3. Sintered iron clutch plates with ventilated type center plates are standard in IBF-314, IBF-318 and IBF-321 units. These plates should not be used in applications where torsionals or vibrations are prevalent. Consult Twin Disc General Products Application Department, Racine, WI 53403.

USE A CERTIFIED PRINT FOR INSTALLATION

Duty Service Classifications

Attention is called to the fact that other application factors must be considered in the selection process in addition to duty service, such as:

SPEED LIMITS · CLUTCH TORQUE LIMITS

The selections are usual dry clutch applications in which the clutch is engaged infrequently and after engagement, it is used in the engaged mode for a long time before disengagement. Generally, the prime mover speed is reduced below 50% of the operating speed for smoother clutch engagement, but this is not a requirement insofar as the clutch is concerned.

Duty Class I: The clutch is used for disconnecting the power from the load. When engaging, so little work is done that the clutch shows no temperature increase at the pressure plate outer surface. Use maximum input torque from the Class I Table, disregard horsepower. The mechanism is operated one (1) or more hours before disconnecting.

Examples: Engagement of clutches with the driven equipment having WR^2 less than that of the clutch and whose torque demand curve is similar to that of a centrifugal pump.

Duty Class II: The clutch is used primarily for disconnect, but does more work during engagement than in Duty Class I. The clutch will engage within two (2) seconds, never heat the pressure plate more than 50°F (27.8°C) above ambient, and once engaged is operated for one (1) or more hours before disconnecting. The maximum horsepower which the clutch can absorb is given in Class II Table.

Examples: Power shovel master clutch, generator, line shafts and similar light duty drives.

Duty Class III: The clutch will engage within three (3) seconds, never heat the pressure plate more than 100°F (55.6°C) above ambient, and once engaged is operated for one (1) or more hours before disconnecting. The maximum horsepower which the clutch can absorb is given in Class III Table.

Examples: Clutches starting average loads, whose load is up to 1.4 times the running load. Blowers, fans, screw compressor, conveyors and similar normal duty drives.

Duty Class IV: The clutch will engage within four (4) seconds, never heat the pressure plate more than 150°F (83.3°C) above ambient, and once engaged is operated for one (1) or more hours before disconnecting. The maximum horsepower which the clutch can absorb is given in Class IV Table.

Examples: Clutches starting heavy loads, and large inertia machinery whose starting load is up to 1.8 times the running load typical of heavy duty drives.

Model	Optional Extra Accessories				
	Cast Iron Driving Ring	Nodular or Steel Driving Ring	Operating Yoke	Hand Lever	Finger Spring
	Part Number	Part Number	Part Number	Part Number	
C-106	6939	NA	X1037	X3799	Avail.
C-107	6661	NA	X1037	X3799	Avail.
C-108	5805	5805A	X1037	X3799	Avail.
C-110	6187A	6187E	X1037	X3799	Avail.
C-111	6625A	6625D	X1037	X3799	Avail.
SP-111	6625A	6625D	X125A	X3799	NA
SP-211	6931	6931T	X3507	X3799	NA
SP-311	NA	6625N*	X5091	X7441A	NA
SP-114	5712	5712B	X5091	X7441A	NA
SP-214	5713	5713D	X5091	X7441A	NA
SP-314	A6518	A6518A	X5091	X7441A	NA
SP-216	6925	6925E	XA5486	X8215C	NA
SP-318	6926A	6926E	XA5486	X8215C	NA
SP-321	6875	6875A	XA5486	X83778	NA
IBF-214	NA	A6518C	XA4650	X7441A	NA
IBF-314	NA	85635	XA4650	X7441A	NA
IBF-318	NA	85352	XB5363A	X83778	NA
IBF-321	NA	9917	XB5363A	X83778	NA
SL-111	6625A	6625D	X125B	X7441A	NA
SL-211	6931	6931T	X3507	X7441A	NA
SL-214	5713	5713D	XB5458	X82158	NA

NOTE 4. SAE grade 8 attachment capscrews required.

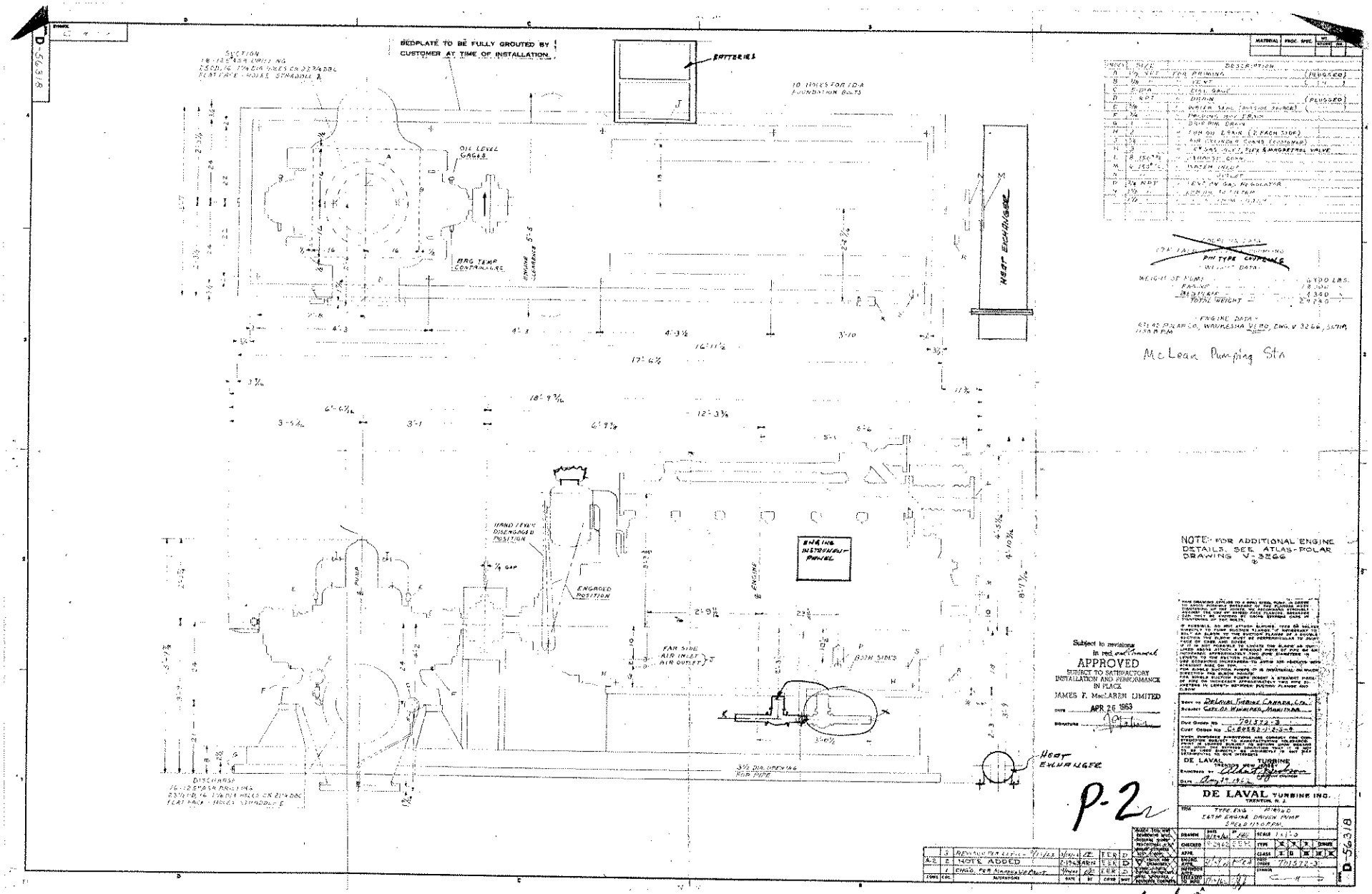
TWIN DISC INCORPORATED
RACINE, WISCONSIN 53403, U.S.A.
ENGLAND SOUTH AFRICA SINGAPORE AUSTRALIA
TWIN DISC INTERNATIONAL S.A.
1400 NIVELLES, BELGIUM

IMPORTANT NOTICE: Twin Disc, Incorporated reminds users of these products that their safe operation depends on use in compliance with engineering information provided in this catalog. Users are also reminded that safe operation depends on proper installation, operation and routine maintenance and inspection under prevailing conditions. It is the responsibility of users (and not Twin Disc, Incorporated) to provide and install guards or safety devices which may be required by recognized safety standards or by the Occupational Safety and Health Act of 1970 and its subsequent provisions.

Appendix D

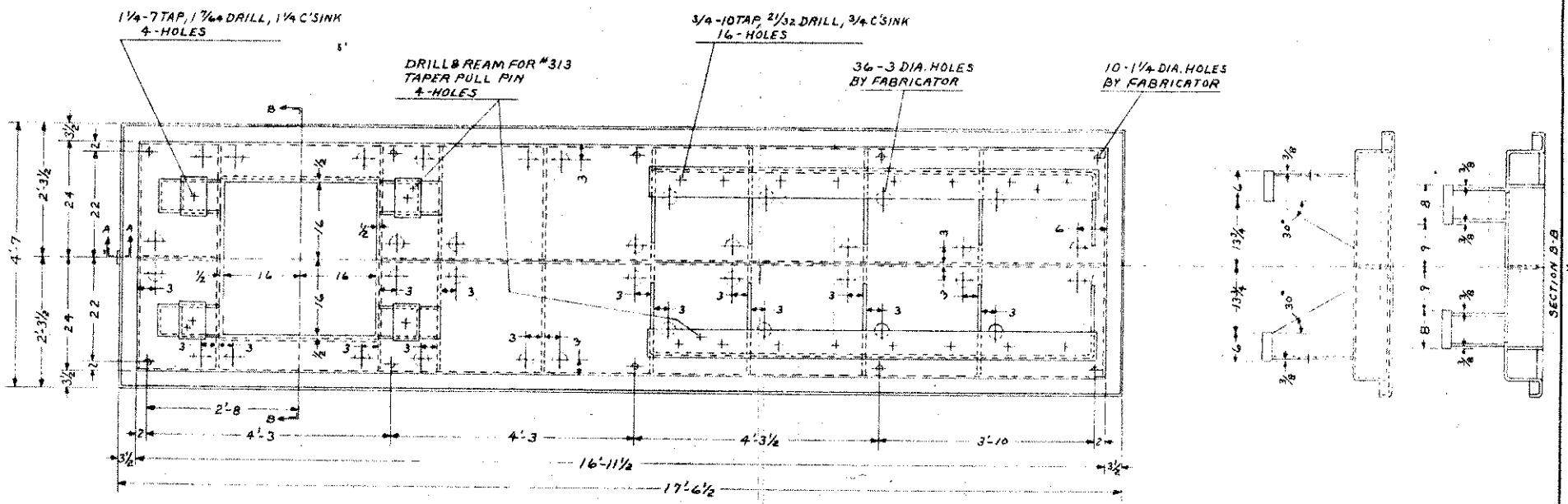
Existing Base Plate Drawing

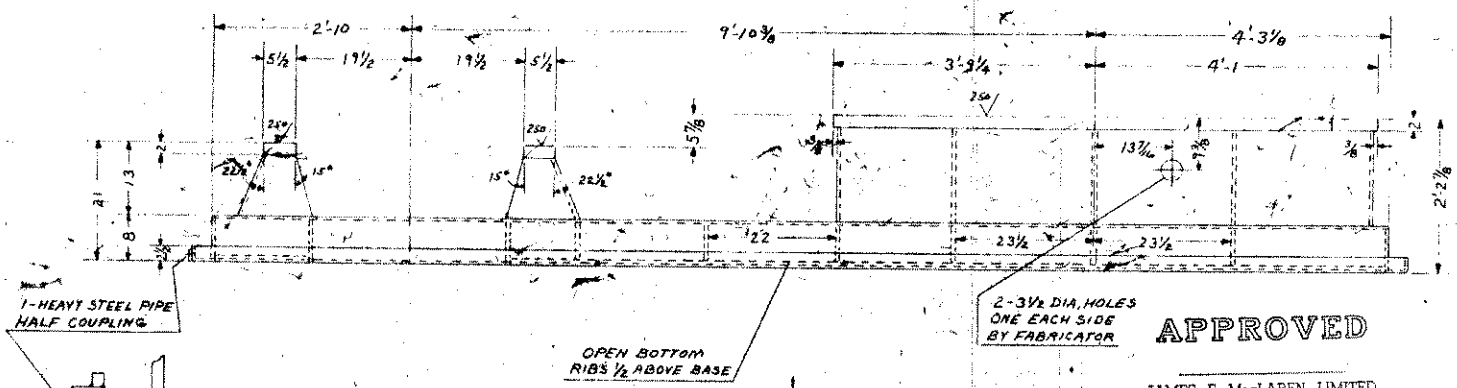
(2 Sheets Follow)


BEDPLATE TO BE FULLY GROUTED BY CUSTOMER AT TIME OF INSTALLATION.
BATTERIES
10 HOLES FOR 1" DIA FOUNDATION BOLTS
SUCTION
OIL LEVEL GAGES
BRG TEMP CONTROLLER
ENGINE CLEARANCE
HEAT EXCHANGER
McLean Pumping Stn
HAND LEVER DISENGAGED POSITION
ENGAGED POSITION
ENGINE INSTRUMENT PANEL
FAR SIDE AIR INLET AIR OUTLET
BOTH SIDES
DISCHARGE
HEAT EXCHANGER
NOTE: FOR ADDITIONAL ENGINE DETAILS, SEE ATLAS-POLAR DRAWING V-3266
APPROVED
SUBJECT TO SATISFACTORY INSTALLATION AND PERFORMANCE IN PLACE.
JAMES F. MacLAREN LIMITED
APR 26 1963
DE LAVAL TURBINE INC.
TRENTON, N. J.
P-2
1/2
D-56318

P-1G

MATERIAL	PROC. SPEC.	WT. ROUGH	WT. FIN.	PT. No.
ST.-GM.	DE13-4	9446	9396	





SECTION A-A

P25

MacLean Pump Stn.

A CONTINUOUS FILLET WELD TO BE USED ON ALL EXPOSED JOINTS. ALL RIBBING IN OPEN BOTTOM OF BEDPLATE TO BE WELDED AS THUS ▽ 3/8-4-4.

NOTE

ALL DIMENSIONS TO SURFACE MARKED 250 INDICATES FINAL FINISH. MAKE SUFFICIENT ALLOWANCE FOR FINISHING. ALL MACHINING TO BE DONE BY DELAVAL. BED PLATE TO BE STRESS RELIEVED BY FABRICATOR AS PER DELAVAL PROCESS SPEC. DE 13-4.

½ STEEL PLATE EXCEPT WHEN NOTED.

APPROVED

JAMES F. MacLAREN LIMITED

PER _____

ZONE	CHG.	ALTERATIONS	DATE	BY	CHKD	WRT
	1	REDESIGNED & REDRAWN	12/18/62	EE	EEK	D

DE LAVAL TURBINE INC.
TRENTON, N. J.

TITLE: BED PLATE

	DATE	BY
DRAWN	12/10/62	EE
CHECKED	12/10/62	EEK
APPR.		
ENGRG. APPR.		
METHODS APPR.		
RELEASED TO MFG.	12/10/62	

SCALE 3/4 : 1'-0
TYPE P CENTER
CLASS II III
FIRST ORDER 701572-3
SYMBOL P-1G
DWG. C-60531

212