

APPENDIX B – FINE SCREENS & PRIMARY FILTERS EQUIPMENT SUPPLY



**City of Iqaluit
Request for Quotation**

**Iqaluit Wastewater Treatment Plant Upgrade
Fine Screens Supply**

Iqaluit, NU

City of Iqaluit
Department of Engineering & Sustainability
P.O. Box 460
Iqaluit, NU
X0A 0H0

Contract Agreement

CITY OF IQALUIT
REQUEST FOR QUOTATION
IQALUIT WASTEWATER TREATMENT PLANT UPGRADE
FINE SCREENS SUPPLY
PROJECT NO. IQA15-4964-C

The Owner, the City of Iqaluit, offers to receive quotations for the supply of fine screens to support the project entitled Iqaluit Wastewater Treatment Plant Upgrade. This package and your quotation will form an integral part of the future contract documents.

The scope of the equipment supply is briefly described as follows:

- Submission of shop drawings and product data, and provision of manufacturers engineering support
- Supply of fine screens including:
 - Two (2) shaftless spiral fine screenings, washing, conveying and dewatering units (abbreviated name: fine screens)
 - Control system
 - Ancillary components and associated appurtenances
- Field support services during installation by others
- Start-up and commissioning assistance
- Personnel training
- Other work as specified in the contract documents

Quotations marked "City of Iqaluit, Iqaluit Wastewater Treatment Plant Upgrade Fine Screens Supply" will be received by email, copied to both the City and Nunami Stantec contacts below, until 2:00 p.m. local Iqaluit time (Eastern Standard Time) on **February 16, 2018**.

As set out in the Instruction to Bidders, the City reserves the right to reject any or all of the Quotations.

Mr. Mathew Hamp
Director of Public Works and Engineering
City of Iqaluit
M.hamp@city.iqaluit.nu.ca

Mr. Glenn Prosko
Senior Project Manager
Nunami Stantec Ltd
Glenn.Prosko@stantec.com

IT.1 Scope of Supply

- 1.1 The Iqaluit Wastewater Treatment Plant Upgrade project (the "Project") involves upgrading an existing primary treatment facility to include secondary treatment. The upgraded primary treatment system will consist of replacement of the existing lift station pumps, new fine screens and new primary filters. The secondary treatment system will consist of moving bed biofilm reactors (MBBRs) followed by dissolved air floatation clarifiers (DAFs). The new equipment (the "Goods") must fit within the existing building and footprint as identified in the Quotation Drawings included under separate cover.
- 1.2 The scope of supply of this Request for Quotation shall consist of the design, supply, fabrication and delivery to the point of the Goods of the Fine Screens and associated equipment. Services shall be included but not limited to all parts, components, accessories, shop drawings, installation instructions and supervision, operation and maintenance manuals, other submittals, factory testing, site acceptance testing, commissioning, training and other services as required.
- 1.3 The Goods will be installed by the General Contractor as part of the Iqaluit Wastewater Treatment Plant Upgrade project (the "Project"). The Supply Contractor ("Bidder") shall furnish all labour, materials and equipment to design, supply, fabricate and deliver the Goods.
- 1.4 All obligations that are described in all of the specifications are obligations of the Supply Contractor unless specified otherwise.
- 1.5 The delivery point is FOB in the City of Iqaluit, Nunavut (sealift and/or air).

IT.2 Relationship of Supply Contractor (Bidder) and General Contractor

- 2.1 Upon the assignment of the Construction Contract, the SUPPLY CONTRACTOR will become a subcontractor to the GENERAL CONTRACTOR.
- 2.2 It is a requirement of the contract that upon assignment of the CONTRACTOR, the Insurance originally provided by the SUPPLY CONTRACTOR to the OWNER be modified to include the same terms to both the OWNER and the CONTRACTOR. Performance bond requirements for manufacture, installation and operation will be met by the SUPPLY CONTRACTOR.
- 2.3 The OWNER will assign the Contract hereunder to a GENERAL CONTRACTOR for the project when such GENERAL CONTRACTOR has been selected. The SUPPLY CONTRACTOR under this contract will be required to join in a Novation Agreement in the form set out in section 00 50 21 as soon as the Construction Contract between the OWNER and GENERAL CONTRACTOR has been signed.
- 2.4 The General Contractor and Supply Contractor will be bound by the terms of the General Contract, with the General Contractor assuming the rights and obligations of the Owner

as set out therein. The Supply Contractor will become a subcontractor in respect to the Construction Contract.

- 2.5 The Supply Contractor will be responsible for all bonding and insurance requirements for the Supply Contractor's equipment.
- 2.6 The Supply Contractor will be duly notified by the City upon award of the Construction Contract.
- 2.7 The Supply Contractor shall coordinate its delivery of Goods to the delivery point with the General Contractor to ensure a timely delivery to match the General Contractors work schedule.
- 2.8 The date of delivery of the Goods to the Delivery Point defines the anticipated time frame when the General Contractor will commence installation of the Goods. The General Contractor, with the approval of the City, may make minor changes to the delivery schedule to best suit the General Contractor's installation project and the Supply Contractor shall adjust its delivery schedule for the Goods accordingly at no additional cost to the City, as long as the requests from the General Contractor are reasonable and they are approved by the City in advance.
- 2.9 If required by the General Contractor to suit the construction schedule and as negotiated between the Supply Contractor and the General Contractor, delivery of the Goods shall be made in multiple deliveries over a time, as necessary, during this timeframe to minimize the time that work is stored on-site prior to installation.
- 2.10 The Supply Contractor will assume full responsibility for protection and safekeeping of all Goods supplied under this Quotation until such time as they are delivered to the delivery point, at which time the General Contractor will assume full responsibility for protection and safekeeping of the Goods.
- 2.11 The Supply Contractor will be responsible to properly and sufficiently identify and tag all Goods supplied under this Quotation to assure proper installation and prevent loss.
- 2.12 The General Contractor and the Engineer will jointly inspect the Goods upon delivery to the Delivery Point, and the Supply Contractor will be notified promptly of any damage prior to off-loading. The General Contractor will be responsible for off-loading, handling, and storage of the Goods at the delivery point and any re-handling prior to installation.

IT.3 Work Schedule

- 3.1 The Construction Contract for the Project is scheduled to be awarded in May, 2018.
- 3.2 The start-up, commissioning and training period for the Headworks (primary treatment) portion of the Project is scheduled to be complete and operational by January 31, 2019.

- 3.3 It is anticipated that the Goods supplied under this Quotation will be required on site by the General Contractor in July, 2018 via sealift or earlier as negotiated between the Supplier and General Contractor.

IT.4 Quotation Call

- 4.1 Quotations fully executed, dated and endorsed will be received on the forms provided, via email copied to **m.hamp@city.iqaluit.nu.ca** and **glenn.prosko@stantec.com**. up to the tender closing time of 2:00 p.m. local Iqaluit time on the **16th day of February, 2018** (the "Closing Time").
- 4.2 The intent of this Request for Quotations is to obtain a formal offer to supply:

Two (2) Fine Screens use in the project Iqaluit Wastewater Treatment Plant Upgrade

herein referred to as the "Work", located at the City of Iqaluit.
- 4.3 Failure by the Bidder to comply with the Instructions to Bidder may result in the Quotation submitted being disqualified. Disqualification shall be at the sole discretion of the City.
- 4.4 The submission of a Quotation constitutes the agreement of the Bidder that all the terms and conditions of the Quotation Documents are accepted by the Bidder and incorporated in its Quotation.
- 4.5 Upon submission of Quotations to, and receipt of Quotations by, the City, the City shall own all right, title and interest in and to the submitted Quotations and a Bidder shall not be entitled to demand return of any such Quotation.
- 4.6 If an arithmetical error is identified by the Engineer in the submitted Quotation between any individual price and the price extension (e.g. Unit Price x Quantity of Units), the individual price shall govern. The price extension and the total Quotation amount will be corrected accordingly.

IT.5 Receipt of Quotations

- 5.1 Quotations must be received via email (the "Closing Location") by the City and Nunami Stantec Ltd. on or before the exact time and date fixed as the Closing Time.
- 5.2 It is the responsibility of the Bidder to ensure that its Quotation is received at the Closing Location before the Closing Time and the Bidder assumes the entire risk of failure of the City to receive any tender at the Closing Location before the Closing Time.
- 5.3 Any Quotations received after the Closing Time shall be rejected and returned unopened to the Bidder. If only one Quotation is received and that Bidder is received late, the Quotation may be accepted at the sole discretion of the City.
- 5.4 Quotations shall be opened as soon as practicable after the Closing Time.

- 5.5 All Quotations submitted by email must be confirmed by delivery of the original to the address below within seven days after the Closing Time, subject to adverse weather or transportation problems.

Mr. Mathew Hamp
Director of Public Works and Engineering
City of Iqaluit
P.O. Box 460
Iqaluit, Nunavut
X0A 0H0

IT.6 Amendments to Quotations

- 6.1 Amendments to a Quotation by email delivered to the Closing Location are acceptable provided that the amendment:

- (i) is received in total on or before the Closing Time;
- (ii) contains the Project name and number, name and address of the Bidder and is signed by the same party or parties who signed the Bidder; and

- 6.2 All amendments submitted by email should be confirmed by delivery of the original to the address below within seven days after the Closing Time, subject to adverse weather or transportation problems.

Mr. Mathew Hamp
Engineering Department
City of Iqaluit
P.O. Box 460
Iqaluit, Nunavut
X0A 0H0

- 6.3 Amendments will not be accepted by facsimile.

IT.7 Duration of Offer

- 7.1 Quotations shall remain open for acceptance and shall be irrevocable for a period of 60 days after the Closing Time, irrespective of the acceptance of any Quotation. Current schedule is to award the general construction contract in May, 2017.

IT.8 Quotation Ineligibility

- 8.1 Quotations that are unsigned, improperly executed, incomplete, conditional, illegible, obscure or contain arithmetical errors, additions not called for, reservations, qualifications, erasures, alterations, or irregularities of any kind, or which are otherwise not completed or submitted in strict compliance with the Instructions to Bidders, may be rejected by the City.

- 8.2 Notwithstanding anything to the contrary herein, the City may in its sole discretion elect to retain any such Quotation for consideration and may waive any or all of the foregoing, on such terms or conditions as the City may consider appropriate, even if any of the foregoing would otherwise render the Quotation null and void and the Quotation may be considered in the same manner as Quotations that fully conform to the requirements of the Quotation Documents without qualification.

IT.9 Review and Acceptance of Quotation

- 9.1 Upon receipt of the Quotations, the City in its discretion may elect to conduct a post quotation meeting with one or more Bidders to discuss in detail their respective Quotation submission and such other items as the City may consider appropriate or necessary.
- 9.2 Before selection of the Quotation to be carried forward into the Project, the Bidder may be required to provide specific information with respect to its legal and or financial status.
- 9.3 The City is looking for proponents, through their submission, to demonstrate that they possess the experience and capabilities to successfully provide the specified equipment. The City may disclose ratings if requested by any of the proponents. Proponents will only be provided their scores and their relative ranking. The submissions will be evaluated on the basis of the criteria below:

Criteria	Weighting
Price (Quotation Sum and Unit Prices)	70%
Schedule of Equipment Data, Schedule of Maintenance and Operating Data and Schedule of Recommended Spare Parts and Special Tools	10%
Compliance with Equipment Size as per Contract Drawings	10%
Schedules of Bidder's Qualifications	10%

- 9.4 THE LOWEST OR ANY QUOTATION WILL NOT NECESSARILY BE ACCEPTED.
- 9.5 Notwithstanding any custom of the trade to the contrary, the City reserves the right to reject the lowest Quotation, even if the lowest Quotation is a compliant Quotation, accept any Quotation or part thereof, negotiate any aspect of any Quotation, advertise for new Quotations, negotiate a contract as the City deems to be most advantageous to the City's interest without incurring any liability, and to award a contract to whomever the City in its sole and absolute discretion deems appropriate and solely in the best interest of the City and no Bidder will have any claim against the City as a consequence. Unless required otherwise by the NNI Policy, the City shall not, at any time, be required to disclose any information to the Bidders regarding the City's consideration and evaluation of Quotations.

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- 9.6 Following acceptance by the City, a written Notice of Selection will be issued to the successful Bidder. No action by the City other than a written "Notice of Acceptance" shall constitute an acceptance of the quotation.
- 9.7 If the City receives no Quotations satisfactory to the City in its sole discretion, the City reserves the right in its sole discretion to negotiate a contract for the whole or any part of the Work with any one or more persons whatsoever, including any one or more of the Bidders, or to postpone or cancel this Quotation and then issue a new Quotation, or to cancel or postpone some or all of the Work.
- 9.8 The City shall not, under any circumstances, be responsible for any costs, expenses, loss, damage or liabilities, whether direct, indirect, consequential or economic in nature, incurred by a Bidder as a result of, in connection with or incidental to:
- 9.8.1 a Bidder quoting for the Work, or
 - 9.8.2 the acceptance or rejection of any Quotation, or
 - 9.8.3 the exercise by the City of its rights under IT.9.5.
- 9.9 By participation in the quotation process, the Bidder on its own behalf and on behalf of all firms, corporations and individuals comprising the Bidder, agrees that none of the City or its directors, officers, employees, agents and other representatives shall be liable to any Bidder, or any firm, corporation or individual comprising the Bidder, including in contract, tort, statutory duty, duty of fairness, duty of care, law, equity or otherwise, for any claims, direct or indirect, whether for costs, expenses, losses or damages, or loss of anticipated profits, or for any matter whatsoever, incurred in preparing and submitting a Quotation, or negotiations of a Contract, or in any way arising in connection with the Quotation Documents. The Bidder further agrees on its own behalf and on behalf of all firms, corporations and individuals comprising the Bidder, that the award of the Contract is in the sole discretion of the City and in no event shall the Bidder or any firms, corporations or individuals comprising the Bidder seek injunctive or other relief to prevent or delay the award of the Contract or the performance of any Work or services in relation thereto.

IT.10 Commencement and Completion of Work

- 10.1 The Bidder, in submitting the Quotation, agrees that the Bidder can complete the Work by the date for completion stated in the Quotation Form.

IT.11 Omissions/Discrepancies/Interpretations

- 11.1 Bidders finding discrepancies or omissions in the drawings or specifications, or having doubt as to the meaning or intent thereof, shall at once notify the Engineer who will, if necessary, send written instructions or explanations to all Bidders.
- 11.2 Oral interpretations made to any Bidder shall not effect a modification of any provision of the Quotation Documents.

- 11.3 Questions arising during the Quotation period should be directed to:

Nunami Stantec Limited

Email: glenn.prosko@stantec.com
Telephone: 780 969 3258

Attention: Mr. Glenn Prosko, P. Eng.

- 11.4 The City reserves the right in its sole discretion at any time and from time to time, and for whatever reason to, by Addendum, modify, amend or otherwise change the Quotation Documents. Any such Addendum shall be issued in writing and shall be expressly identified as an Addendum to these Quotation Documents. All such changes shall become part of the Quotation Documents and their effects shall be reflected in the Quotation prices. The City also reserves the right in its sole discretion to cancel this Quotation at any time.

IT.12 Alternatives

- 12.1 Where selected products are stipulated in the Quotation Documents the Quotation shall be based on the use of only these selected products.
- 12.2 Proposals for alternative products may be considered if submitted as an attachment to the Quotation.
- 12.3 Submissions shall provide sufficient information to enable the Engineer to determine the acceptability of such products.
- 12.4 Provide complete information on required revisions to other work and products to accommodate each alternative product, and the amount of addition or reduction from Quotation prices, including required revisions, for each alternative product.
- 12.5 Unless a proposal for an alternative product is submitted in this manner and later accepted, provide the product specified.
- 12.6 Prior approval to submit a proposal for an alternative product with the Quotation is not required.

IT.13 Approved Manufacturers

- 13.1 The design drawings and specifications are based upon the design components of a singular selected supplier/manufacturer and is the Design Standard Manufacturer.
- 13.2 Where additional Acceptable Manufacturers are listed:
- 13.2.1 Equipment provided by Acceptable Manufacturer shall be of the same or greater quality than equipment from the Design Standard Manufacturer.

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- 13.2.2 All Acceptable Manufacturer equivalent equipment must conform to the intent of the Design Standard Manufacturer including technical specification, type, performance, materials of construction, motors, seals, controls, etc., unless approved by the Engineer.
- 13.2.3 The Contractor is responsible for any piping, valving and fitting modifications that may occur from approved equivalent equipment by Acceptable Manufacturers.
- 13.2.4 The Contractor is responsible for any structural or architectural modifications that may occur from approved equivalent equipment by Acceptable Manufacturers.
- 13.2.5 The Contractor is responsible for any electrical, plumbing, HVAC and controls modifications that may occur from approved equivalent equipment by Acceptable Manufacturers.
- 13.2.6 The Contractor is responsible for all additional engineering costs incurred as a result of providing the equivalent Acceptable Manufacturer. This includes, but is not limited to, the Owner's costs for review of approved manufacturer's design data, changes to the contract document designs and preparation of record drawings.

IT.14 Goods and Services Tax

- 14.1 The City will pay the Goods and Services Tax (GST) which will be included in the Quotation price.
- 14.2 The successful Bidder may invoice for Goods and Services Tax (GST).

IT.15 Metric Products

- 15.1 All Quotation Documents are in the metric system, and unless noted otherwise, metric products shall be used.

IT.16 Site Examination

- 16.1 The Bidder, either personally or through a representative, may examine the Site before submitting a Quotation, and shall satisfy itself as to the nature and location of the Work, local conditions, the equipment and facilities needed prior to and during the prosecution of the Work, the means of access to the Site, on-Site accommodation, all necessary information as to risks, contingencies and circumstances which may affect its Quotation, and all other matters which can in any way affect the Work. The Bidder is fully responsible for obtaining all information required for the preparation of the Quotation.
- 16.2 The Bidder is directed to contact Mathew Hamp at the City at 867 979 6363 in order to arrange a date and time to visit the Site.
- 16.3 Claims for additional costs will not be entertained with respect to conditions which would reasonably have been ascertained by an inspection of the Site prior to the Closing Time.

IT.17 Quotation Signing

- 17.1 The Quotation must be executed under seal by the Bidder.
- 17.2 If the Bidder is an individual or a partnership, the Bidder shall be executed by the individual or a partner in the presence of a witness and the signatory must show the capacity in which he or she signs (e.g. "Partner" or "Proprietor").
- 17.3 If the Bidder is a corporation, the Quotation shall be executed under the seal of the company, affixed in the presence of the authorized officers or two directors.
- 17.4 If the Bidder is a joint venture, each party to the joint venture shall execute the Quotation under seal in the manner appropriate to such party.

IT.18 Appendices to Quotation Form

- 18.1 Bidders shall complete all Appendices attached to the Quotation Form and submit these with the Tender.

IT.19 Working Hours

- 19.1 Work inside the existing facilities shall be carried out between the hours of: 7:00 A.M. and 6:00 P.M. on weekdays and between 7:00 A.M. and 6:00 P.M. on weekends unless other arrangements are made between the City and the Contractor.

IT.20 Provisional Items

- 20.1 Once a Bidder has been chosen by the City for the Project, it shall be open to the City to accept, reject or negotiate the Bidder's Quotation for any provisional item contained in the Quotation. Should the City choose to reject the successful Bidder's bid for such provisional work, it shall be open to the City to call for new Quotations for this work and the successful Bidder for the Project may submit a Quotation if they so choose.

IT.21 Transportation of Materials

- 21.1 Transportation/shipping and handling of materials and all costs thereof are the responsibility of the Bidder unless otherwise noted. Modes of transporting materials shall be decided by the Bidder unless by marine transport in which case GC 14 shall apply.

END OF SECTION

CONTENTS OF THE CONTRACT DOCUMENTS

SPECIFICATIONS

No. Pages

DIVISION 00 Procurement and Contracting Requirements

	Notice to Proceed	1
Section 00 10 00	Request for Quotation	1
Section 00 21 00	Instruction to Bidders	9
Section 00 30 00	Table of Contents	1
	Contract Modification Correspondence	3
Section 00 41 00	Quotation Form	25
Section 00 52 00	Articles of Agreement	4
Section 00 52 21	Novation Agreement	4
Section 00 72 00	General Conditions	47
Section 00 73 00	Supplementary General Conditions	1
	Addendum	2

DIVISION 01 General

Section 01 29 00	Payment Procedures	3
Section 01 33 00	Submittal Procedures	5
Section 01 42 00	References	5
Section 01 61 00	Common Product Requirements	6
Section 01 78 00	Closeout Submittals	8
Section 01 79 00	Demonstration and Training	17
Section 01 91 13	General Commissioning Requirements	9

DIVISION 40 Process Integration

Section 40 05 00	General Provisions- Process	10
Section 40 05 13	Process Piping	35
Section 40 05 13.01	Detailed Process Piping Specification Sheets	11
Section 40 05 23	Process Valves	28
Section 40 05 30	Process Piping and Coating Systems	25
Section 40 05 40	Process Identification	4
Section 40 05 50	Electric Motors Less than 150 kW	10

DIVISION 46 Wastewater Equipment

Section 46 21 33	Fine Screen	15

APPENDICES

Appendix A	Preliminary Equipment Layouts
Appendix B	Preliminary P&IDs

END OF SECTION

Prosko, Glenn

From: Steve Rioux <srioux@enviro-care.com>
Sent: Tuesday, March 06, 2018 12:02 PM
To: Prosko, Glenn
Cc: eslam.maher@colliersprojectleaders.com; m.hamp@city.iqaluit.nu.ca; Weir, Dixon; Dominic Janssen; Gary Garzonetti; Paquin, Zach; Rojas, Alejandro; Alan Spratt
Subject: RE: City of Iqaluit, Iqaluit Wastewater Treatment Plant Upgrade - Fine Screens Supply - Project No. IQA15-4964-C

Glenn –

Confirming we can meet the delivery schedule upon receipt of notice to proceed by March 9th, 2018. As we discussed during our conference call we will provide two submittals:

1. Mechanical submittal including layout drawing so we may receive a quick approval to start the manufacturing of the screen units, which are the longest lead time item.
2. A controls submittal will follow a few weeks after the mechanical submittal.

We look forward to receiving the Notice to Proceed.

Thank You -

Stephen J. Rioux
Inside Sales Manager



1570 St. Paul Avenue
Gurnee, IL 60031
Direct Line: 224-302-0308
Cell: 847-987-5150
www.enviro-care.com

From: Prosko, Glenn [mailto:Glenn.Prosko@stantec.com]
Sent: Tuesday, March 06, 2018 12:32 PM
To: Steve Rioux <srioux@enviro-care.com>
Cc: eslam.maher@colliersprojectleaders.com; m.hamp@city.iqaluit.nu.ca; Weir, Dixon <Dixon.Weir@colliersprojectleaders.com>; Dominic Janssen <dominic@watertech.ca>; Gary Garzonetti <ggarzonetti@enviro-care.com>; Paquin, Zach <Zach.Paquin@stantec.com>; Rojas, Alejandro <Alejandro.Rojas@stantec.com>
Subject: RE: City of Iqaluit, Iqaluit Wastewater Treatment Plant Upgrade - Fine Screens Supply - Project No. IQA15-4964-C

Hello Again Steve

Have you had a chance to review the email below?

In order to get you the Notice to Proceed as soon as possible, we need your response.

Thanks,
Glenn

From: Prosko, Glenn
Sent: Friday, March 02, 2018 11:24 AM
To: 'Steve Rioux' <srioux@enviro-care.com>
Cc: eslam.maher@colliersprojectleaders.com; m.hamp@city.iqaluit.nu.ca; Weir, Dixon <Dixon.Weir@colliersprojectleaders.com>; Dominic Janssen <dominic@watertech.ca>; Gary Garzonetti (ggarzonetti@enviro-care.com) <ggarzonetti@enviro-care.com>; Paquin, Zach <Zach.Paquin@stantec.com>; Rojas, Alejandro <Alejandro.Rojas@stantec.com>
Subject: RE: City of Iqaluit, Iqaluit Wastewater Treatment Plant Upgrade - Fine Screens Supply - Project No. IQA15-4964-C

Hello Steve

As we discussed today, we would like to confirm a delivery date to Iqaluit for the supply of the Fine Screens.

Based on:

- Notice to Proceed - March 9, 2018, formal execution of contract agreement to follow
- Preparation and submission of shop drawings
 - Staged review of Mechanical and Electrical/I&C acceptable
- Nunami Stantec return comments of submission(s) – 2 weeks
- Authorization to proceed with manufacturing upon shop drawing approval(s)

The intent is for the Contractor to receive the equipment early fall for a 4 month plant shutdown, and installation and commissioning of the equipment in that period. Expected completion of commissioning January 31, 2019.

Is a commitment of September 1, 2018 for arrival in Iqaluit of the equipment acceptable to Enviro-Care?

Please review and advise

Also as discussed and for information only, attached is the anticipated overall project schedule. Please keep in mind this schedule is dependent on the General Contractor's schedule and is subject to change. Currently we are anticipating accelerating the fine screen supply and an award of the general contract mid-May.

We look forward to working with you

Glenn Prosko, P.Eng.

Senior Project Manager

Stantec

10160 112 Street, Edmonton AB T5K 2L6

Phone: (780) 969-3258

Cell: (587) 926-7981

Glenn.Prosko@stantec.com



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Please consider the environment before printing this email.

From: Steve Rioux [<mailto:srioux@enviro-care.com>]

Sent: Friday, February 16, 2018 11:31 AM

To: m.hamp@city.iqaluit.nu.ca; Prosko, Glenn <Glenn.Prosko@stantec.com>

Cc: eslam.maher@colliersprojectleaders.com

Subject: City of Iqaluit, Iqaluit Wastewater Treatment Plant Upgrade - Fine Screens Supply - Project No. IQA15-4964-C

Dear City of Iqaluit –

Attached you will find our quotation for the supply of fine screens as per your RFQ.

If you have any questions please feel free to contact me by phone (224-302-0308) or email.

Thank You -

Stephen J. Rioux
Inside Sales Manager



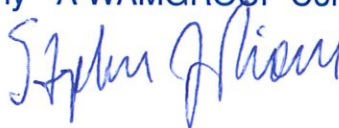
1570 St. Paul Avenue
Gurnee, IL 60031
Direct Line: 224-302-0308
Cell: 847-987-5150
www.enviro-care.com

Date: February 14, 2018

Submitted by: Enviro-Care Company - A WAMGROUP Company

Name: Stephen Rioux

Address: 1570 St. Paul Ave
Gurnee, Illinois 60031



Telephone: 815-636-8306
224-302-0308

To: City of Iqaluit
City Hall
Iqaluit, Nunavut

Project Iqaluit Wastewater Treatment Plant Upgrade – Fine Screens Supply
Project Number IQA15-4964-C

The undersigned Bidder, having carefully examined the Quotation Documents and the Site, and having full knowledge of the Work and of the materials and products to be furnished and used, hereby agrees to provide all necessary materials, products, supervision, labour and equipment and perform and complete all Work and fulfill everything for the stipulated lump sum price of:

(Total in Words)

One Hundred Seventy Two Thousand Seven Hundred Fifty Five Dollars

\$ 172,755

in Canadian funds, which price includes all specified cash and contingency allowances and the applicable taxes in force at this date including GST.

The undersigned also agrees:

1. That the provisions of the Instruction to Bidders apply, including without limitation provisions that provide that City is in no way obligated to accept this Quotation, the City may at its sole discretion to accept any Quotation or part thereof or waive any defect, irregularity, mistake or insufficiency and accept any Quotation or alternative proposal, in whole or in part, which is deemed by the City to be most favourable to its interest, and that limit the City's liability.
2. That GST is included in the Quotation price.
3. That the estimate of quantities shown in Quotation Documents serves only to provide a basis for comparing Quotations and that no representations have been made by either the

City or the Engineer that the actual quantities correspond therewith, and further, that the City has the right to increase or decrease the quantities in any or all items and to eliminate items entirely from the Work.

4. That this Quotation is made without knowledge of the Quotation prices to be submitted for the Work by any other company, firm or person.
5. That this Quotation is made without connection or arrangement with any company, firm or person submitting a tender for the Work.
6. That this Quotation is made without any undisclosed connection or arrangement with any other company, firm, or person having an interest in this Quotation or in the proposed contract.
7. That this Quotation is irrevocable for 60 days after the Closing Time and that the City may at any time within such period accept this Quotation whether any other contract has previously been awarded or not and whether acceptance of another Quotation has been given or not.
8. That payment for the Work done will be made on the basis of the quantities measured by the Engineer and at the Quotation prices shown in the Quotation Form which shall be compensation in full for the Work done under the terms of the Construction Contract.
9. That payment of the contingency allowance or portion thereof will only be made in the event that the Engineer authorizes work, in which case the amount of payment will be determined as specified in the General Conditions. Any unused portion thereof will be retained by the City.
10. To complete the Work by the dates outlined in the Quotation Documents, or if no schedule is stated, to substantially perform the Work by January 31, 2019, subject to the provisions of Section 6 of the General Conditions for extension of the Construction Contract Time.
11. That should the undersigned fail to complete the Work in the time specified above, they shall compensate the City in accordance with GC 6 of the General Conditions.
12. That the undersigned has carefully examined the Work described herein, has become familiar with local conditions and the character and extent of the Work, has carefully examined every part of the proposed contract and thoroughly understands its terms and conditions, has determined the source of supply and transport of the materials required, has investigated labour conditions and has arranged for the continuous performance of the Work described in the Quotation Documents.
13. Changes
 - 13.1 When the Engineer establishes that the method of valuation for extras in the Work will be net cost plus a percentage fee in accordance with GC 8.2
 - 13.2 On work deleted from the Contract, the credit to the City shall be an estimated net cost approved by the Engineer plus one half the overhead and profit percentage noted in GC 8.2.

14. Addenda

- 14.1 The following Addenda have been received. The modifications to the Tender Documents noted therein have been considered and the effects are included in the Tender prices.

Addendum # 1, dated February 14, 2018.

Addendum # _____, dated _____.

Addendum # _____, dated _____.

PART 1 GENERAL

1.1 Content of the Quotation Forms

- .1 The Schedules in the Quotation Form are offered for information and are subject to review by the City, who may require these Schedules to be modified before acceptance of the Quotation. Modifications may be required for good cause, including but not limited to:
 - .1 Unbalanced breakdown prices
 - .2 Unacceptable Suppliers or Manufacturers
 - .3 Unacceptable additional unit prices
 - .4 Unacceptable supervisory personnel
 - .5 Other causes
- .2 The Bidder warrants that all of the information given in these Schedules is current and correct. Changes to any schedule in the Quotation Form, agreed upon by the City and the Bidder, after closing of the Quotation Period but before Construction Contract Award shall not in any way affect the Validity of the Quotation.
- .3 Upon acceptance by the City and award of the Construction Contract, all Schedules in the Quotation Form shall become a part of the Construction Contract.

1.2 Schedule of Breakdown Prices

- .1 The Bidder offers the following Schedule of Breakdown Prices to be used as a basis for progress payments. The Bidder understands that the City may refuse to accept any breakdown which they consider to be unbalanced and may require an adjustment to correct any such imbalance, without changing the total Quotation Price.

Item No.	Description	Amount (Lump Sum) \$ CDN
1	Engineering Services including design assistance, submission of shop drawings and technical data, including expenses (Shall not exceed 10% of Subtotal Quotation Sum) Note: 10% progress holdback will not be applied for this portion of the work.	\$ 14,808
2	Equipment Supply and Delivery, including factory testing, FOB City of Iqaluit (Shall not exceed 70% of Subtotal Quotation Sum)	\$ 114,196
3	Site Services for Start-Up and Commissioning	\$ 20,831
4	Operation and Maintenance Training	\$ 12,514
5	Supply and Delivery of Spare Parts and Special Tools (FOB jobsite)	\$ 2,180
	SUBTOTAL QUOTATION SUM (SUB-TOTAL 1 TO 5) =	\$ 164,529
6	GST, 5%	\$ 8,226
	TOTAL QUOTATION SUM INCLUDING GST (TOTAL 1 TO 5) =	\$ 172,755

1.3 Schedule of Unit Prices for Additional Work Items

- .1 The following unit price items are for additional work, or alterations to the work. Additional work shall only be performed upon the written request of the City and are not included in the Total Quotation Sum.

Item No.	Additional Item Description	Amount (Lump Sum) (excluding GST) \$ CDN
1	On-site Technical Support • Provide one site visit of two days duration on-site per year by trained operations technician/engineer to inspect the system, provide a report on the systems condition and performance and to provide refresher and/or advanced training to operators at the City's direction. • Cost to be provided as annual cost for the next 10 years including travel and accommodation subject to adjustment by the Consumer Price Index as published by Statistics Canada commencing accrual from substantial completion date. The City reserves the right to cancel the contract at any point during the 10 year period.	\$ 8,450

1.4 Schedule of Equipment Data

The Bidder shall provide product data for equipment proposed with the quotation submission. Acknowledge the information has been included with the quotation by checking the appropriate boxes below:

.1	An itemized component list showing items to be furnished (products and services) including materials of construction, catalogue data on all components.	☒ Attached
.2	General arrangement plan and section drawings showing critical dimensions.	☒ Attached
.3	General layout drawings showing proposed equipment overlaid on Engineer's Quotation drawings, showing how equipment will fit into the required space and showing how all connections will be made from the Supplier's termination points to the Engineer's interconnecting drawings.	☒ Attached
.4	Process & Instrumentation drawings showing all equipment included.	☒ Attached
.5	Control Philosophy illustrating the operation of the supplied system in all modes of operation.	☒ Attached ☒ Attached
.6	Electrical single line diagram.	
.7	Summary of electrical and other utility requirements.	☒ Attached
.8	A schedule of all the required key process variables including flow, fluid pressures and temperature ranges at the boundaries of the Supplier's scope of work.	☒ Attached
.9	List of recommend spare parts furnished with the equipment and costing information.	☒ Attached
.10	List of recommended special tools furnished with the equipment and costing information.	☒ Attached

1.5 Schedule of Maintenance and Operating Data

- .1 The following information is to be provided such that the performance and operational costs for the system can be evaluated.
- .2 See Section 46 21 33 Fine Screens for requirements.
 - .1 Maintenance and Operating data based on Average Annual Flow conditions at a minimum design temperature of 10° C when not stated otherwise.

1.6 Schedule of Recommended Spare Parts and Special Tools

- .1 Bidder to recommend and provide the following spare parts and special tools for operation of the Fine Screens. These spare parts and special tools are to be included in the Quotation price. Attach additional sheets if required.

Description	Unit Price (excluding GST) (\$ CDN)	Quantity	Price (excluding GST) (\$ CDN)
Brushes	\$ 1090	2 sets	\$ 2180
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
	\$		\$
SUBTOTAL (to be transferred to Breakdown of Prices)			\$

1.7 Schedule of Force Account Rates

- .1 The Supplier offers to do force account work for the following rates for personnel. Personnel daily rates include payroll cost of labor, all payroll burdens, couriers, subsistence, documentation, communication, overhead and profit. The cost of superintendents, time keepers, and other administrative and supervisory personnel and their vehicles are included in overhead.
- .2 The Supplier understands that the City may review these Force Account Rates and require changes for good cause

Personnel: Occupation Or Trade	Daily Rate (8 hour day)	Expenses (per day)	Travel Cost per Trip
Site Service Engineer	\$ 1,690	\$ 452	\$ 4,360
	\$	\$	\$
	\$	\$	\$
	\$	\$	\$
	\$	\$	\$

1.8 Schedule of Bidder's Qualifications

- .1 The Bidder states that the following is a true account of his qualifications and experience on work similar to The Work.
- .2 Only the Fine Screens which meet the following experience requirements shall be considered acceptable for this project:
 - .1 Minimum of ten (5) operating references of Fine Screens, delivered by the Supplier with the following criteria:
 - .1 Using the same process proposed (shaftless spiral fine screenings, washing, conveying and dewatering units)
 - .2 Average flow of at least 50 liters per second or greater
 - .3 In North America
 - .4 At Least five (5) years in experience in the market

	Name of WWTP	Year	Fine Screen Average Flow Capacity (L/s)	Fine Screen Peak Flow Capacity (L/s)	Owner/Engineer	Telephone Number
1	Hermiston WWTP	2013	91	274	Bill Schmittle	541-567-5272
2	Dutchman's Creek Pump Station	2008	50	88	Tom Johnson	336-751-2635
3	Lynden WWTP	2013	55	131	Tamara Adams	360-354-0633
4	Roann	2006	N/A	65	Bruce Shaw	260-571-8182
5	Skagit WWTP	2013	N/A	50	Brian Walker	360-661-0932

- .2 At least one (1) customer reference where a warranty concern was raised by a client, and addressed by the Supplier to the satisfaction of the client. Provide details to the Engineer and a customer contact.

	Name of WWTP	Year	Fine Screen Average Flow Capacity (L/s)	Fine Screen Peak Flow Capacity (L/s)	Owner/Engineer	Telephone Number
1	Chappell WWTP	2016	2.7	9.5	Jerrod Helms	308-890-0111

1.9 Schedule of Bidder's Supervisory Personnel

- .1 The Bidder states that the following supervisory personnel shall be employed on this Contract.

Name	Position	Qualifications and Relevant Experience
Shannon Omark	Engineering Manager	BSME, MS in Mgmt Technology, 5-Years Experience in Waste Water Engineering/Operations
Jeff Watry	Director of Operations	P.E. Mechanical Engineering, MS in Mech Eng, 40- Yrs Experience in Waste Water Engineering/Operations

1.10 Schedule of Manufacturers/Suppliers Material and Product

- .1 The Bidder states that the following Manufacturers/Suppliers of Material and Product shall be utilized for the major supply items on this Contract.

Item	Manufacturer
Tank Assembly	Enviro-Care - A WAMGROUP Co.
Screen Basket	Enviro-Care - A WAMGROUP Co.
Spiral Screw Assembly	Enviro-Care - A WAMGROUP Co.
Screenings Transport Zone	Enviro-Care - A WAMGROUP Co.
Screenings Compaction Zone Assembly	Enviro-Care - A WAMGROUP Co.
Spray Wash System	Enviro-Care - A WAMGROUP Co.
Drive Unit	NORD
Control Panel	Elemech Inc.
Safety Microswitches	Honeywell
Ultrasonic Level Sensors	Siemens

- .2 The Bidder agrees that, if a named Manufacturer/Supplier is not acceptable to the City the Bidder shall name an alternative, acceptable to the City, before Award of the Contract.

END OF SECTION

Scope of Supply

Itemized scope of supply with flow variables and key process information

Project:

Iqaluit Wastewater Treatment Plant Upgrade – Fine Screens Supply
Project Number IQA15-4964-C

Equipment:

SPECO WasteMaster® Tank Mounted Screw Screens Model GCPC600

Engineer:

Nunami Stantec Limited

Represented By:

Waste'n WaterTech Ltd.
Dominic Janssen
Phone: 403-252-9056
Email: dominic@watertech.ca

Regional Sales Manager:

Enviro-Care
Alan Spratt
Phone: 224-302-0304
Email: aspratt@enviro-care.com

Project No.: WEC217259

February 16, 2018



1570 St. Paul Avenue - Gurnee IL 60031
P: 815.636.8306
F: 847.672.7968
www.enviro-care.com



Itemized scope of supply with flow variables and key process information

ITEM: "A" - Two (2) SPECO WasteMaster®
Tank Mounted Screw Screens
Model GCPC600



BASIS OF DESIGN (Flow and Key Process Information) (EACH SCREEN)

Application:	Continuous Raw Wastewater Screening
Annual Average Flow:	38.5 L/s
Peak Hourly Flow per Screen:	151 L/s
Tank Length:	1990 mm
Tank Width:	635 mm
Tank Depth:	1370 mm
Screen Opening:	6 mm
Opening Type:	Perforated
Angle of Inclination:	35 degrees
Maximum Upstream Water Level:	692 mm
Influent Flange Size:	400 mm
Effluent Flange Size:	400 mm
Screenings Discharge:	400 mm
Discharge Height:	1540 mm from mounting floor
Screenings Capture Rate (SCR):	52%

FINE SCREEN (EACH SCREEN)

- Integral screen tank with hinged access door from type 316L stainless steel. Tank supplied with mounting flange for ultrasonic level sensor, vent and hinged access door.
- Tank shall be sized to allow screen to pivot to an angle parallel with the mounting floor.
- Semi-cylindrical screenings basket from type 316L stainless steel
- Conveyor tube with wear bars from type 316L stainless steel bolted to the transport tube using 316 stainless steel bolts.
- Neoprene side seals fastened to basket to prevent bypass around the screen.
- Shaftless spiral screw from high strength alloy steel with protective primer coating and brushes attached in the basket area. Brushes are supplied in individually replaceable

sections each covering 180° of the spiral and shall have nylon bristles molded into a plastic core and attached to the screw with 316 stainless steel fasteners.

- Basket mounted spray bar from type 316L stainless steel.
- Dual chambered dewatering and discharge zone from type 316L stainless steel with hinged access door.
- Dewatering zone drain flush spray system from type 316L stainless steel with manual ball valve.
- Plastic hose for drain connection to direct pressate back into the channel.
- Centralized washing system with type 316 stainless steel piping and rubber reinforced hose, connecting all unit spray locations to single point for customer connection. Includes manual ball valves and solenoids.
- Drive unit with 2.0 HP TEFC (Class 1, Division 2) motor suitable for 575/3/60 electrical supply.
- Fasteners – 316 stainless steel.

FINE SCREEN SUPPORTS (EACH SCREEN)

- A stand from type 316L stainless steel is supplied to support the fine screen unit.

CONTROL PANEL AND INSTRUMENTATION (EACH SCREEN)

- One (1) NEMA 4X type 316L stainless steel wall mount main control panel suitable for 600/3/60 electrical supply. Control panel shall contain the following control devices for operation of the spiral screen.
 1. Main disconnect with through door interlock handle.
 2. Control transformer 600/120.
 3. Branch circuit protection.
 4. Screen motor starter, reversing (IEC) with overloads.
 5. Current/Load monitor for screen motor overtorque/overload protection.
 6. Emergency stop pushbutton.
 7. Screen HOA switch.
 8. Basket spray wash Open-Close-Auto switch.
 9. Dewatering zone spray wash Open-Close-Auto switch.
 10. Hour meter for each motor.
 11. Run and Off indicating lights.
 12. Alarm lights indicating overcurrent and starter overload.
 13. Programmable control relay for screen and blower control logic.
 14. Alarm reset pushbutton.
 15. Run and alarm auxiliary contacts.
 16. UL Label.
- One (1) NEMA 4X Emergency Stop pushbutton station with sealed contacts for use in a Class 1, Zone 2 area.
- Two (2) NEMA 4/7 safety microswitches mounted to tank access door and dewatering/discharge access door (Class 1, Zone 2).

- One (1) NEMA 4x 120V solenoid valve to control water spray functions, suitable for installation in a Class 1, Zone 2 area.
- One (1) Ultrasonic Level Controller: A 120V single point level controller shall be provided in a windowed NEMA 4X polycarbonate enclosure suitable for wall mounting, to receive and interpret a 4-20mA scaled signal from an upstream and downstream transducer. The controller shall have 6 internal relays and provide an LCD display.
- One (1) ultrasonic level transducer shall be provided with type 316 stainless steel mounting brackets and expansion anchor. Sensor shall have an ETFE housing with an integral sensor to provide compensation for acoustic variations due to temperature. Sensor shall have a range of 1-33 ft and be supplied with a 33 ft integral cable. Sensor shall be suitable for installation in a Class 1, Division 1, Group D area.

SPARE PARTS / SPECIAL TOOLS (TOTAL)

- One (1) set of spare brushes for each screen.
- (no special tools required)

Warranty Statement and Term:

- Enviro-Care Company, Inc. warrants the supplied equipment to the original end user against defects in workmanship or material under normal use and service in compliance with the original design specifications and the maintenance requirements and instructions as found in the Operations & Maintenance Manual. All Enviro-Care supplied equipment is warranted for 12 months from date of start-up or 18 months from date of shipment, whichever occurs first.

FIELD SERVICE (TOTAL)

- Five (5) trips for a total of six (6) days onsite for installation inspection, start-up and operator training.

CLARIFICATIONS/COMMENTS

- Equipment installation provided by others, not Enviro-Care.
- All piping not integral to our unit as depicted on our Drawing WEC217259-C, Sheets 3 and 4 are to be provided by others, not Enviro-Care.

OPTIONAL ITEMS (EACH)

- None.

SUBMITTALS

- Full submittals will be supplied approximately 4 to 6 weeks after receipt and acceptance of purchase order at the Enviro-Care offices.

SHIPMENT:

- Shipment time is approximately 18 to 20 weeks after receipt of approved submittal is received at the Enviro-Care offices. Under no circumstances will verbal approval be accepted.

NOTE: ANY ITEM NOT LISTED ABOVE TO BE FURNISHED BY OTHERS.

EXCLUSIONS

Electrical wiring, conduit or electrical equipment, piping, valves, or fittings, shimming material, lubricating oil or grease, shop or field painting, field welding, erection, hoist or lifting apparatus, detail shop fabrication drawings, performance testing, unloading, storage, concrete work, civil design, grating, platforms, stairs, hand railing, dumpster **(except as specifically noted)**.

This proposal section has been reviewed for accuracy and is approved for issue:

By: Stephen Rioux Date: February 16, 2018

Control Philosophy

Sequence of Operation GCP Wastemaster Screw Screen

SPIRAL SCREEN MODES OF OPERATION:

HAND:

When Screen Selector is in the HAND position, the Screen will run per the Screen FOR-OFF-REV selector. In FOR position, the Screen runs continuously forward. In OFF position, the Screen is off. In REV position, the Screen runs in reverse until operator release (spring-returns to OFF).

AUTO:

When the Screen selector is in the AUTO position, the Screen will start forward when the liquid level in the upstream channel reaches the start level set-point (as determined by upstream ultrasonic level sensor).

After the liquid level in upstream channel falls below the start level set-point for the time set in the Screen Level Off-Delay Timer, the Screen will shut off.

The Screen will also cycle OFF and ON/FOR (OFF first), per the settings of the Screen Repeat Cycle Timer (adjustable). The Screen Repeat Cycle Timer is provided for 3 possible reasons:

1. To keep the Screen operating periodically in low flow situations.
2. In case there is a failure with the upstream level sensing device.

Notes:

1. Any run of the Screen will reset the Screen Repeat Cycle Timer.
2. After each automatic cycle, the Screen will stop, run in reverse (stop and reverse times are set per Screen Reverse Run Timer), and then return to OFF.
3. If the Screen call-to-run signal remains active for the time set in the Screen Max Continuous Run Timer, the Screen will stop and run in reverse (stop and reverse times are set per Screen Reverse Run Timer). If the call-to-run persists, the Screen will again start to run in the forward direction.
4. Pressing and holding the System Reset pushbutton for 3 seconds will initiate a Screen Run cycle if the Screen selector is in the AUTO position.

COMPACTION ZONE SPRAY MODES OF OPERATION:

HAND:

When the Compaction Zone Spray selector is in the HAND position, the Compaction Zone Spray will run continuously.

AUTO:

When the Compaction Zone Spray selector is in the AUTO position, the Spray will cycle ON and OFF (ON first) per the settings of the Compaction Zone Spray Repeat Cycle Timer (adjustable). The Compaction Zone Spray is independent of the Screen operation.

BASKET SPRAY MODES OF OPERATION:

HAND:

When the Basket Spray selector is in the HAND position, the Basket Spray will run continuously.

AUTO:

When the Basket Spray selector is in the AUTO position, the Spray will run when the Screen is operating in forward.

EMERGENCY STOP:

If the Emergency Stop (E-Stop) pushbutton is pressed, the Spiral Screen, the Compaction Zone Spray, and the Basket Spray will stop immediately. Screen and Sprays will also stop if the tank hatch is opened or the compaction /discharge zone hatch door is opened. To re-set, pull out E-Stop pushbutton and press the System Reset pushbutton.

SPIRAL SCREEN FAULTS/Resets:

1. A fault occurs when the Screen Current/Load Monitor is tripped. The Screen will stop immediately, and the Screen Fault light will be illuminated.
Reset: Push the System Reset button.
2. A fault occurs when the Screen Motor Starter Thermal Overload is tripped. The Screen will stop immediately, and the Screen Fault light will be illuminated.
Reset: Push the Reset pushbutton on the Screen Motor Starter Thermal Overload located inside the control panel. Unless entry into the control panel is being performed by a qualified electrician, the control panel power should be shut off prior to entry.
3. A fault occurs when the Screen Motor Thermostat (if supplied) is tripped. The Screen will stop immediately.
Reset: Fault 3 resets automatically when the Screen Motor returns to a safe temperature.

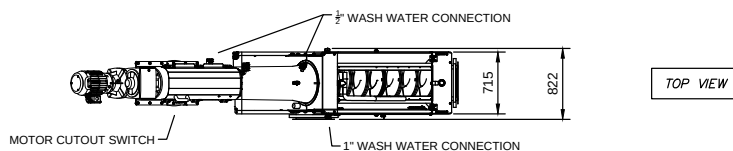
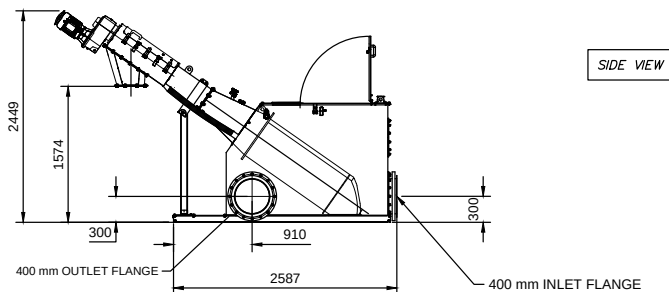
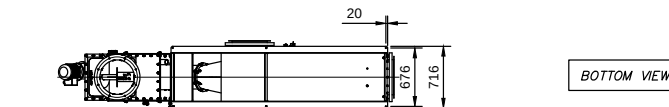
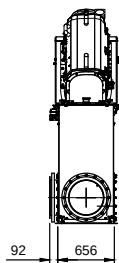
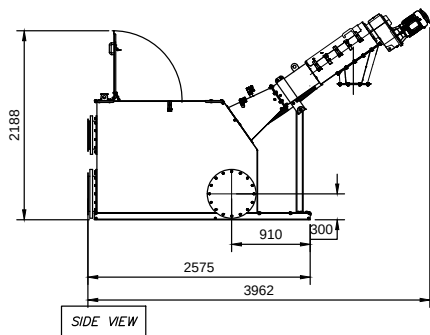
Summary of Electrical and Utility Requirements

Electrical (see attached Single Line Diagram and P&ID for complete details)

1. Main Power Feed: 600 volt, 3-phase, 60 Hertz
2. Motor HP: 1.5 kW – 575 volt, 3-phase, 6- Hertz.
 - a. Full Load Amps: 2.7
3. Basket Spray Solenoid Valve: 110 volt
 - a. In Rush: 70VA
 - b. Holding: 25 VA
4. Compaction Zone Solenoid Valve: 110 volt
 - a. In Rush: 30VA
 - b. Holding: 16 VA
5. Ultrasonic Sensor: 110 volt

Other Utility Requirements

1. Wash water for Screen Basket Spray
 - a. 1 L/s @ 275 – 414 kPa
2. Wash water for Compaction Zone Spray
 - a. 0.5 L/s @ 275 – 414 kPa



LEFT SIDE EFFLUENT
NOT TO SCALE

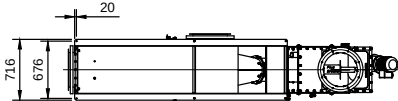
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A	ADDED PLAN VIEW OVERLAY	02-15-2018	JW24	SR08
Rev	Revision Description	Date	Rev By	Approver



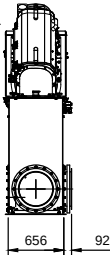
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Status: INFORMATION ONLY				
Title GENERAL ARRANGEMENT: IQALUIT WWTP MODEL: GPC600-LC3500 SPEC0 SCREW SCREEN IN A TANK				
Designer JW24	Checker SR08	Date 02-12-2018	Sheet 3 of 4	
Third Angle Projection		Drawing Number WEC217259-C		Revision A

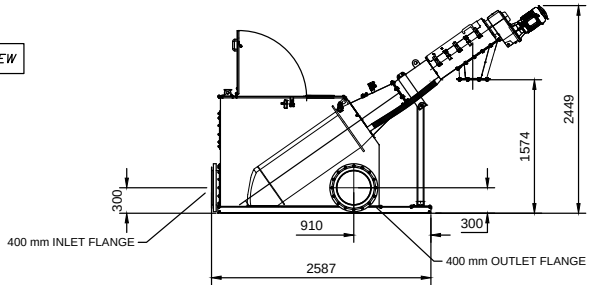
BOTTOM VIEW



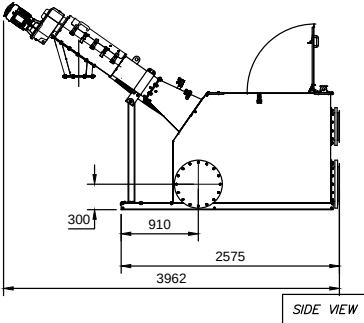
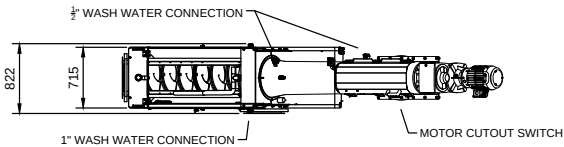
FRONT VIEW



SIDE VIEW



TOP VIEW



SIDE VIEW

RIGHT SIDE EFFLUENT
NOT TO SCALE

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A	ADDED PLAN VIEW OVERLAY	02-15-2018	JW24	SR08
Rev	Revision Description	Date	Rev By	Approver

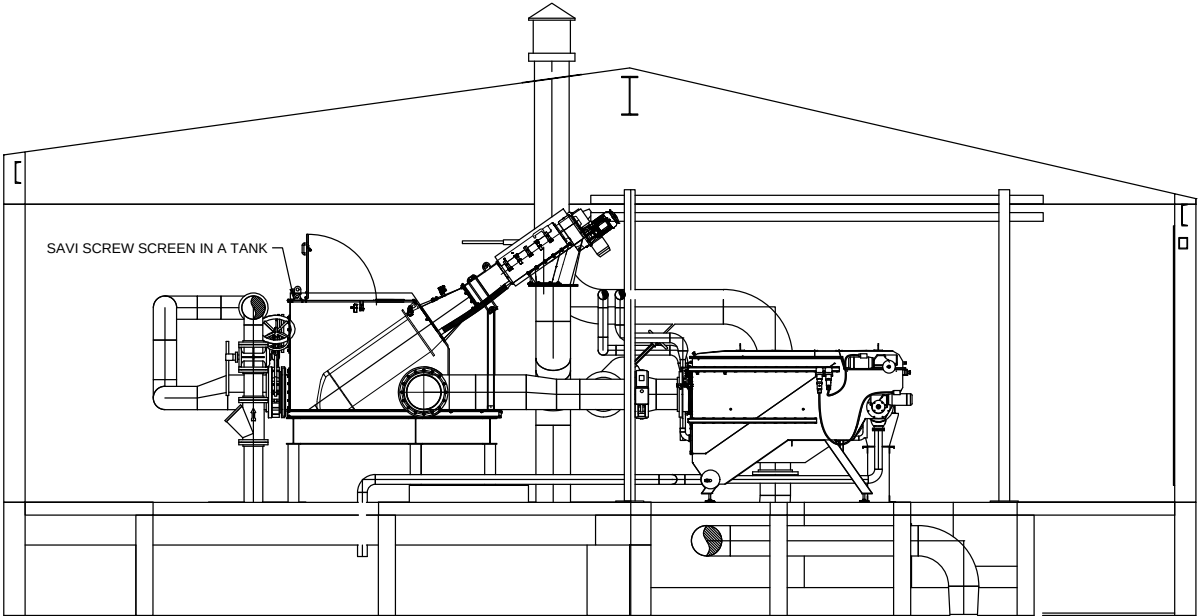


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Title GENERAL ARRANGEMENT: IQALUIT WWTP MODEL: GPC600-LC3500 SPEC0 SCREW SCREEN IN A TANK				
Designer JW24	Checker SR08	Date 02-12-2018	Sheet 4 of 4	
Third Angle Projection		Drawing Number WEC217259-C		Revision A

GENERAL EQUIPMENT LAYOUT OVERLAY
TAKEN FROM ENGINEERING DRAWING P505



PROCESS DESIGN INFORMATION (EACH SCREEN):
APPLICATION: DOMESTIC SEWAGE SCREENING
PEAK DESIGN FLOW: 151 l/s
ANGLE OF INCLINATION: 35 DEGREES FROM HORIZONTAL
DISCHARGE HEIGHT: 1574 mm BOTTOM OF SCREENS
SCREEN PERFORATION: 6 mm

ELEVATION
NOT TO SCALE

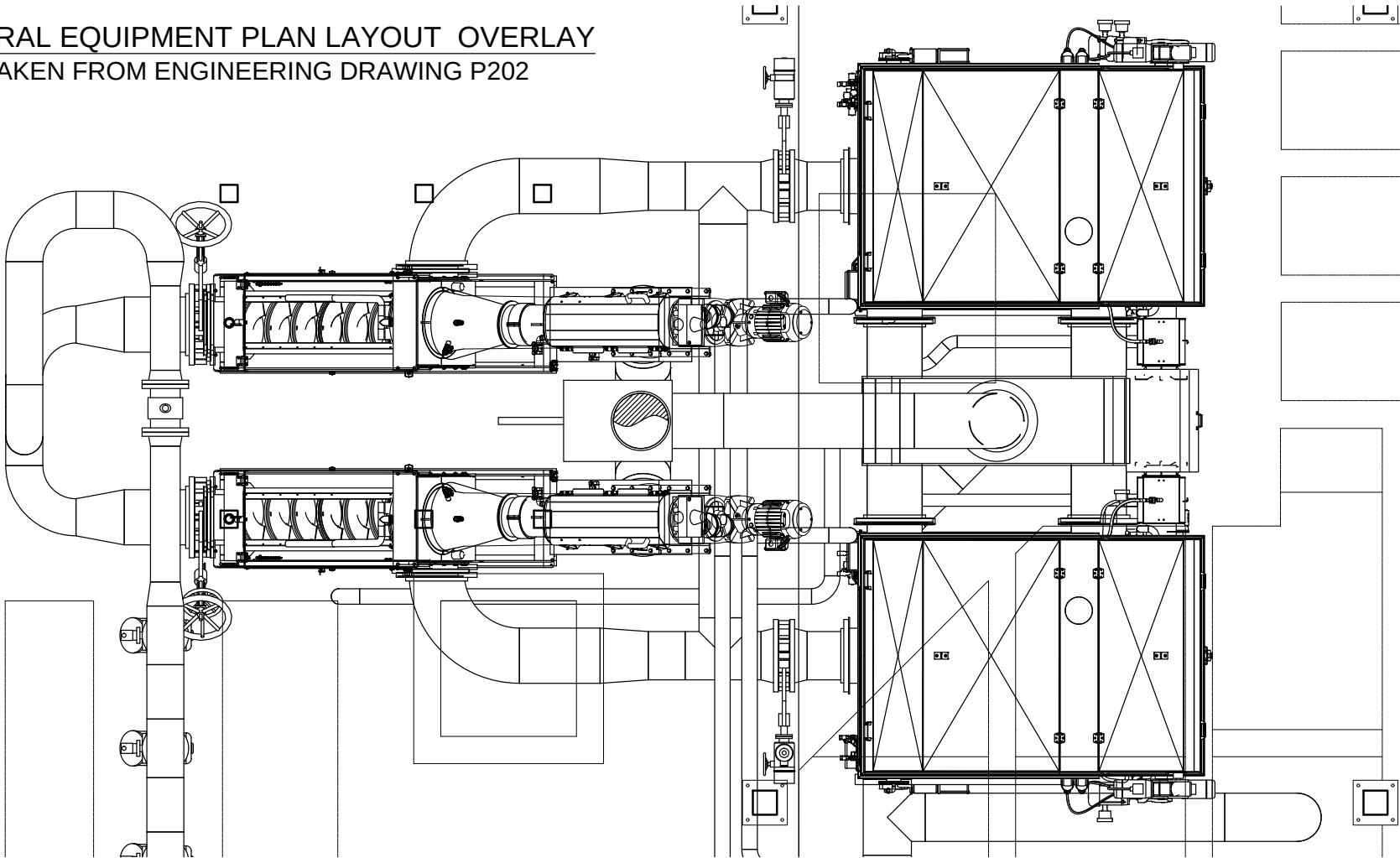
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A	ADDED PLAN VIEW OVERLAY	02-15-2018	JW24	SR08
Rev	Revision Description	Date	Rev By	Approver



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Status: INFORMATION ONLY			
Title GENERAL ARRANGEMENT: IQALUIT WWTP MODEL: GPC600-LC3500 SPEC0 SCREW SCREEN IN A TANK			
Designer JW24	Checker SR08	Date 02-12-2018	Sheet 1 of 4
Third Angle Projection		Drawing Number WEC217259-C	Revision A

GENERAL EQUIPMENT PLAN LAYOUT OVERLAY
TAKEN FROM ENGINEERING DRAWING P202



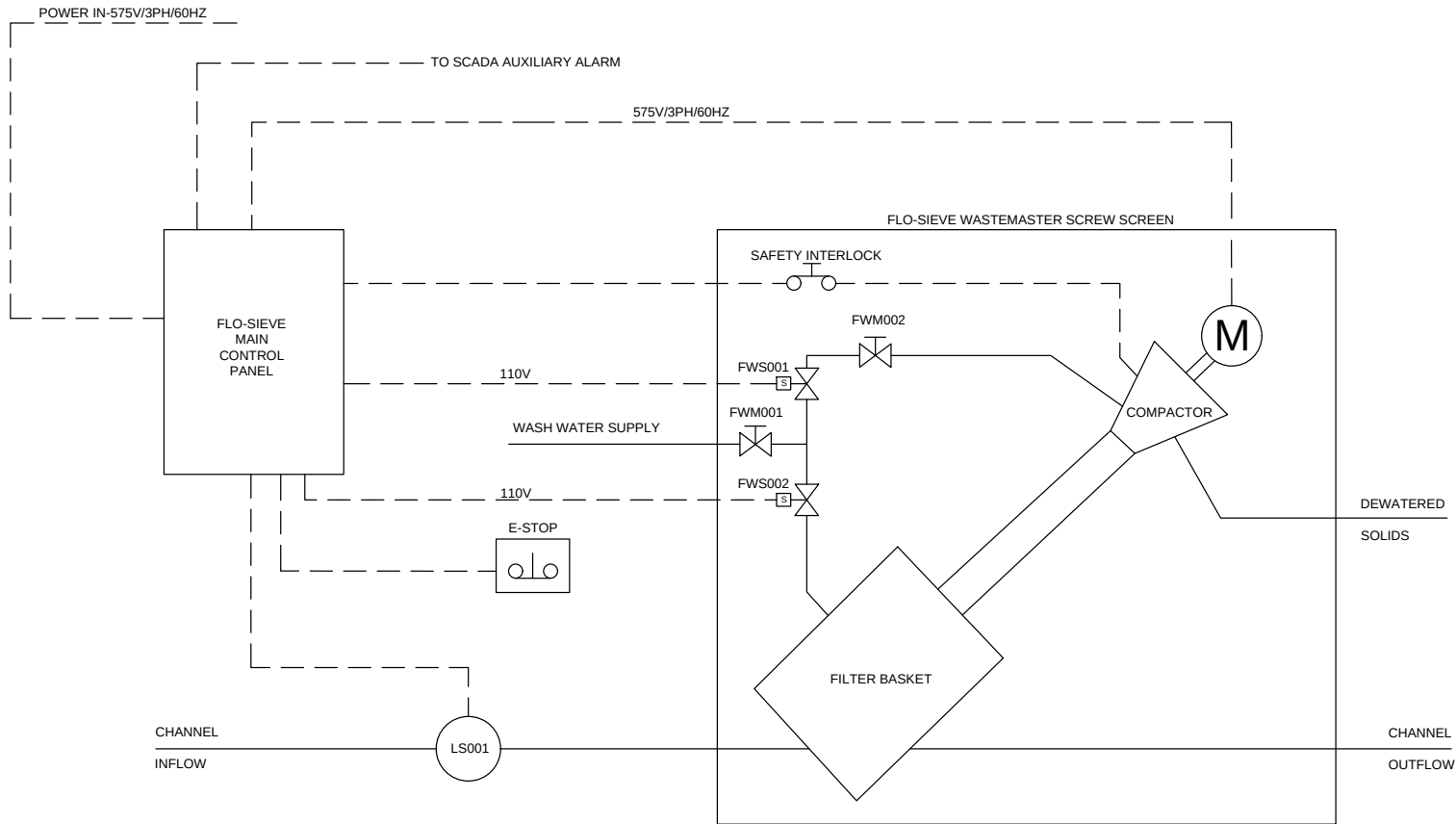
PLAN VIEW
NOT TO SCALE

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A	ADDED PLAN VIEW OVERLAY	02-15-2018	JW24	SR08
Rev	Revision Description	Date	Rev By	Approver



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Status: INFORMATION ONLY				
Title GENERAL ARRANGEMENT: IQALUIT WWTP MODEL: GPC600-LC3500 SPEC0 SCREW SCREEN IN A TANK				
Designer JW24	Checker SR08	Date 02-12-2018	Sheet 2 of 4	
 Third Angle Projection	Drawing Number WEC217259-C		Revision A	



D				
C				
B				
A				
Rev	Revision Description	Date	Rev By	Approver



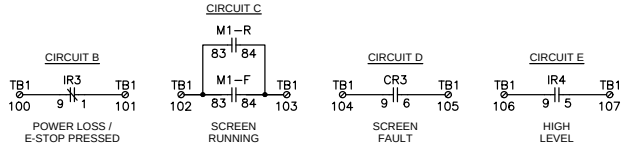
Enviro-Care
A WAMGROUP® Company

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Status: INFORMATION ONLY			
Title INQALUIT, NUNAVUT CANADA PIPING AND INSTRUMENTATION DIAGRAM SPECO FLO-SIEVE WASTEMASTER SCREW SCREEN			
Designer JW24	Checker CK09	Date 02-12-2018	Sheet 1 of 1
Drawing Number WEC217259 P&ID		Revision -	

DRY OUTPUT CONTACTS

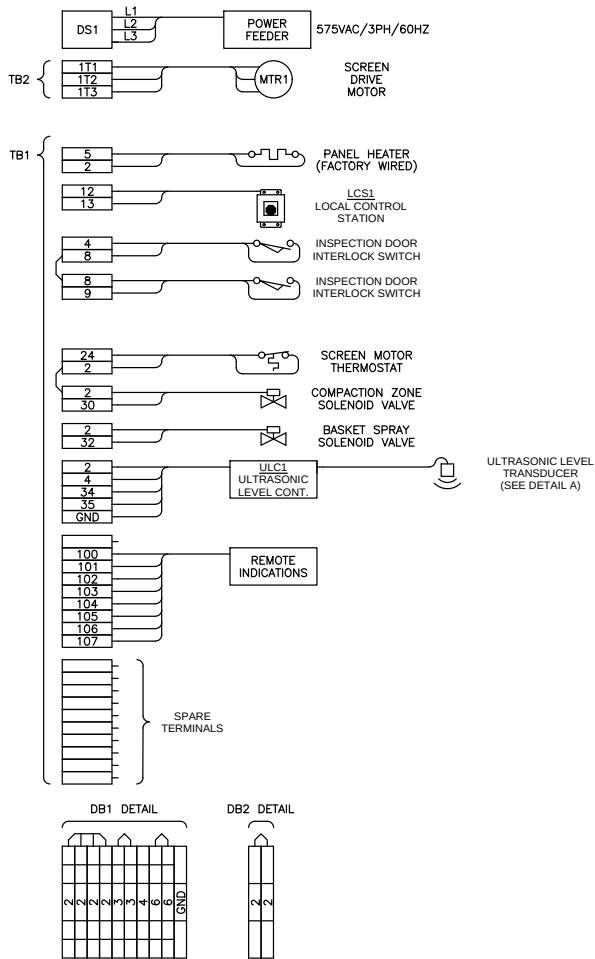
NOTE: IR3 WILL BE NORMALLY CLOSED, POWERED OPEN AND WILL CLOSE WHEN THE E-STOP IS PRESSED.



MAX. CONTROLLED LOAD: 10A @ 120VAC

NOTE: BRANCH CIRCUIT PROTECTION PROVIDED BY OTHERS PER N.E.C.

SINGLE LINE FIELD WIRING DIAGRAM



Status: INFORMATION ONLY				
Title GENERAL ARRANGEMENT: INQALUIT, NUNAVUT CANADA ELECTRICAL SINGLE LINE DRAWING				
Designer JW24	Checker SR08	Date 02-12-2018	Sheet 1 of 1	Revision
Third Angle Projection		Drawing Number WEC217259		-

D				
C				
B				
A				
Rev	Revision Description	Date	Rev By	Approver



DOCUMENT 00 52 20 – ARTICLES OF AGREEMENT

THIS AGREEMENT MADE IN DUPLICATE THIS 9th DAY OF MARCH, 2018

BETWEEN:

THE CITY OF IQALUIT

("the City")

– and –

Enviro-Care Company

("the Contractor")

ARTICLES OF AGREEMENT

IN CONSIDERATION of the mutual promises and obligations contained in the Contract Documents, the City and the Contractor agree as follows:

A1. CONTRACT DOCUMENTS

- 1.1 The documents forming the Contract between the City and the Contractor, referred to herein as the Contract Documents shall consist of:
- (a) these Articles of Agreement;
 - (b) the document attached hereto entitled "General Conditions";
 - (c) the document attached hereto entitled "Supplementary General Conditions";
 - (d) the documents attached hereto entitled "Plans and Specifications";
 - (e) the documents attached hereto entitled "Tender Documents"; and
 - (f) any amendment or variation of the Contract Documents that is made in accordance with the General Conditions.
- 1.2 The City hereby designates Nunami Stantec Ltd.. as the Engineer for the purposes of the Contract.
- 1.3 In the Contract:
- (a) "Fixed Price Arrangement" means that part of the Contract that prescribes a lump sum as payment for performance of the Work to which it relates; and
 - (b) "Unit Price Arrangement" means that part of the Contract that prescribes the product of a price multiplied by a number of units of measurement of a class as payment for performance of the Work to which it relates.

-
- 1.4 Any of the provisions of the Contract that are expressly stipulated to be applicable only to a Unit Price Arrangement are not applicable to any part of the Work to which a Fixed Price Arrangement is applicable.
- 1.5 Any of the provisions of the Contract that are expressly stipulated to be applicable only to a Fixed Price Arrangement are not applicable to any part of the Work to which a Unit Price Arrangement is applicable.

A2. DATE OF COMPLETION OF WORK AND DESCRIPTION OF WORK

- 2.1 The Contractor shall between the date of these Articles of Agreements and the 31st day of January, 2019, in a careful and workmanlike manner, diligently perform and complete the following Work:

Supply and Commission Fine Screens for City of Iqaluit Wastewater Treatment Plant Upgrade

which is more particularly described in the Plans and Specifications and is based on a supply date of September 1, 2018.

A3. CONTRACT PRICE

- 3.1 Subject to any increase, decrease, deduction or set-off that may be made under the Contract, the City shall pay the Contractor at the times and in the manner set out or referred to in the General Conditions.
- 3.1.1 the sum of \$172,755.00 in consideration for the performance of the Work or the part thereof that is subject to a Fixed Price Arrangement, including goods and services tax (GST); and
- 3.1.2 a sum that is equal to the aggregate of the products of the number of units of measurement of each class of labour, plant and material, as certified by the Engineer, multiplied in each case by the appropriate unit price that is set out in the Unit Price Table in consideration for the performance of the Work or the part thereof that is subject to a Unit Price Arrangement, including goods and services tax (GST).
- 3.2 For the information and guidance of the Contractor and the persons administering the Contract on behalf of the City, but not so as to constitute a warranty, representation or undertaking of any nature by either party, it is estimated that the total amount payable by the City to the Contractor for the part of the Work to which a Unit Price Arrangement is applicable will not exceed NOT APPLICABLE, GST included.
- 3.3 A3.1.1 is applicable only to a Fixed Price Arrangement.
- 3.4 A3.1.2 and A3.2 are applicable only to a Unit Price Arrangement.
- 3.5 The Contract Price shall include Goods and Services Tax.

A4. ADDRESSES

4.1 For all purposes of the Contract, the Contractor's address shall be deemed to be:

Enviro-Care Company
1570 St. Paul Ave
Gurnee, Illinois 60031

4.2 For all purposes of the Contract, the City's address shall be deemed to be:

City of Iqaluit
P.O. Box 460
Iqaluit, Nunavut X0A 0H0

SIGNED, SEALED AND DELIVERED in the presence of:

CONTRACTOR:

Per: _____
Signature _____ Witness _____

Name _____ Date _____

Position

Per: _____
Signature _____ Witness _____

Name _____ Date _____

Position

Contractor's Seal

MUNICIPAL CORPORATION OF THE CITY OF IQALUIT

Per: _____
Mayor Date

Per: _____
Senior Administrative Officer Date

City's Seal

END OF SECTION

DOCUMENT 00 52 21 – NOVATION AGREEMENT

BETWEEN: CITY OF IQALUIT
(OWNER)

AND:

(GENERAL CONTRACTOR)

AND:

Enviro-Care Company
(SUPPLY
CONTRACTOR)

WHEREAS:

- A. Owner entered into a Contract with Enviro-Care Company for the supply of Fine Screens (Contract), which is annexed hereto in the Appendices;
- B. It is a requirement of the Contract that the Supply Contractor enter into a Novation Agreement with the General Contractor selected by the Owner;
- C. Owner entered into a contract with General Contractor dated _____, for _____ (Construction Contract);
- D. It is a requirement of the Construction Contract that the General Contractor enter into a Novation Agreement with Supply Contractor so that the Supply Contractor becomes a subcontractor to General Contractor;

NOW THEREFORE in consideration of the premises and of the mutual agreements hereinafter contained the parties agree as follows:

- 1. The General Contractor and Supply Contractor agree to be bound by the terms of the Contract, annexed hereto in the Appendices, with the Contractor assuming all the rights and obligations of the Owner as set out therein.
- 2. Supply Contractor retains all the rights and obligations set out in the Contract and henceforth accepts the General Contractor in place of the Owner.
- 3. Supply Contractor agrees that henceforth it is a subcontractor to the General Contractor in respect of the Construction Contract.

4. Supply Contractor hereby releases the Owner from all of the Owner's obligations under the Contract and from all claims of every nature whatsoever arising therefrom, excepting only those claims, if any, already notified to the Owner in writing, and acknowledges that it will henceforth look only to the General Contractor for the discharge of the Owner's obligations thereunder and that only the General Contractor may exercise the rights of the Owner thereunder.
5. Henceforth, the terms and conditions of the Construction Contract insofar as they can apply to a subcontract shall govern the relations between the General Contractor and the Supply Contractor; provided nevertheless, that if any term of the Construction Contract is inconsistent with any payment provision or Special Condition or Special Provision in the Contract such payment provision, Special Condition or Special Provision of the Contract shall prevail.
6. The Owner and Supply Contractor agree that the Contract between them has been terminated.
7. It is agreed that as of the date hereof \$_____ is owing to the Supply Contractor under the Contract. IN WITNESS WHEREOF the parties have hereunto affixed their hands and seals this _____ day of _____, 2018.

CITY OF IQALUIT

Per: _____

(Title)

Per: _____

(Title)

**GENERAL CONTRACTOR
FOR INDIVIDUAL OR PARTNERSHIP**
SIGNED SEALED AND DELIVERED by:

General Contractor (please print)
In the presence of

Signature

Name

Title

Address

City/Province/Postal Code

Seal

FOR LIMITED COMPANY:
The Corporate Seal of

General Contractor (please print)
was hereunto affixed in the presence of:

Seal

Authorized Signing Officer Title

Authorized Signing Officer Title

NOTE: If the General Contractor is a joint venture, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

**SUPPLY CONTRACTOR
FOR INDIVIDUAL OR PARTNERSHIP**
SIGNED SEALED AND DELIVERED by:

Supply Contractor (please print)
In the presence of

Signature

Name

Title

Address

City/Province/Postal Code

Seal

FOR LIMITED COMPANY:
The Corporate Seal of

Supply Contractor (please print)
was hereunto affixed in the presence of:

Seal

Authorized Signing Officer Title

Authorized Signing Officer Title

NOTE: If the Supply Contractor is a joint venture, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT 00 50 21

**THE CITY OF IQALUIT
CONSTRUCTION CONTRACT
GENERAL CONDITIONS**

Table of Contents

1.	GENERAL PROVISIONS.....	1
1.1	Definitions.....	1
1.2	Documents and Interpretation.....	2
1.3	Notices	5
1.4	Rights and Remedies	5
1.5	Assignment.....	6
1.6	Applicable Law	6
1.7	Successors and Assigns.....	6
2.	CITY'S OBLIGATIONS	6
2.1	Payment	6
2.2	Site Availability	6
2.3	Engineer as Representative.....	6
2.4	Reference Points	7
2.5	Materials Supplied by the City	7
2.6	Control of the Work.....	7
2.7	Limitation of Liability	7
3.	CONTRACTOR'S OBLIGATIONS	7
3.1	General Obligation.....	7
3.2	Independent Contractor	7
3.3	Review of Contract Documents	8
3.4	Site Conditions	8
3.5	Temporary Structures	8
3.6	Schedule	8
3.7	Superintendent	9
3.8	Subcontractors	9
3.9	Other Contractors	10
3.10	Use of the Site	10
3.11	Survey	10
3.12	Protection of the Work, Property and the Public.....	11
3.13	Permits	11
3.14	Applicable Laws.....	11
3.15	Material and Plant Supplied by City	12
3.16	Equipment, Plant and Material Supplied by Contractor	12
3.17	Workers' Compensation Act	12
3.18	Occupational Health and Safety	13
3.19	Cutting and Patching	13
3.20	Defective Work	14
3.21	Testing and Inspection.....	14
3.22	Site Cleanliness.....	15
3.23	Claims Against and Obligations of the Contractor.....	16
3.24	Patent Rights.....	16
3.25	Royalties.....	16
3.26	Records to be Kept by Contractor.....	16
3.27	Public Ceremonies and Signs.....	17
3.28	Non-Compliance by Contractor.....	17
4.	ADMINISTRATION BY ENGINEER	17
4.1	Engineer's Duties and Authority.....	17
4.2	Observing the Work.....	18
4.3	Engineer's Decision.....	18

5.	PAYMENT AND COMPLETION.....	19
5.1	Progress Payments	19
5.2	Contract Holdbacks	19
5.3	Substantial Completion.....	20
5.4	Final Completion.....	21
5.5	Final Progress Payment	21
5.6	Holdback Release	21
5.7	Delay in Making Payment	22
5.8	Right of Set-off.....	22
6.	TIME AND DELAYS.....	23
6.1	Time of the Essence	23
6.2	Delays	23
7.	ASSESSMENTS AND DAMAGES FOR LATE COMPLETION.....	23
7.1	Late Completion	23
8.	CHANGE ORDERS.....	24
8.1	Changes in the Work	24
8.2	Valuation of Changes	24
8.3	Contingency Allowance	26
9.	DISPUTE RESOLUTION.....	26
9.1	Engineer's Decision	26
9.2	Appointment of Referee.....	27
9.3	Appointment of Arbitrator.....	28
9.4	Adherence to Provisions.....	29
10.	WITHDRAWAL, SUSPENSION AND TERMINATION	29
10.1	Withdrawal of the Work.....	29
10.2	Suspension of the Work.....	29
10.3	Termination by City.....	30
10.4	Contract Cancellation	31
10.5	Termination by Contractor	32
11.	BONDS AND WARRANTY	32
11.1	Obligations to Provide Contract Security.....	32
11.2	Prescription of Acceptable Contract Security	32
11.3	Return of Security Deposit.....	33
11.4	Warranty.....	33
12.	INDEMNIFICATION AND INSURANCE.....	34
12.1	Indemnification by Contractor	34
12.2	Indemnification by City.....	34
12.3	Policies of Insurance.....	34
12.4	Insurance General	37
13.	LOCAL and INUIT INVOLVEMENT	37
13.1	Requirements for Inuit, Local and Nunavut Content.....	37
13.2	Requirement for Community Meetings.....	38
13.3	Monitoring the Level of Inuit, Local and Nunavut Labour	39
13.4	Failure to Comply with Proposed Inuit, Local and Nunavut Content.....	39
13.5	Requirement for Using Hotels or Bed and Breakfast.....	41
14.	TRANSPORTATION OF MATERIALS.....	42
14.1	Marine Transport	42

1. GENERAL PROVISIONS

1.1 Definitions

The following terms, whenever used in the Contract Documents, shall mean:

- (a) **“Adjustment”**: a change in either the Contract Price or the Contract Time, or both, in accordance with the applicable provisions of the Contract Documents;
- (b) **“Applicable Laws”**: any and all applicable laws, rules, regulations, by-laws, codes and orders of any and all government bodies, agencies, authorities and courts;
- (c) **“Arbitrator”**: the person appointed under GC 9.3(a);
- (d) **“Articles of Agreement”**: the executed Articles of Agreement;
- (e) **“Change Order”**: a written instrument prepared by the Engineer and signed by the City and the Contractor stating their agreement upon:
 - (i) A change in the Work, and
 - (ii) The method and/or the amount of Adjustment, if any;
- (f) **“City”**: the party defined as such in the Articles of Agreement;
- (g) **“Claim”**: any or all of:
 - (i) A demand or assertion by the City or the Contractor seeking an interpretation of Contract terms, an Adjustment, or other relief with respect to the terms of this Contract;
 - (ii) Other disputes and matters in question between the City and the Contractor arising out of or relating to this Contract; and
 - (iii) Allegations by the City or the Contractor of errors or omissions on the part of the Engineer;
- (h) **“Completion Date”**: the date of Substantial Completion of the Work, as certified by the Engineer;
- (i) **“Construction Schedule”**: the Construction Schedule referred to in GC 3.6, including revisions thereto as provided in GC 3.6, GC 10.2(d) or otherwise required by the Engineer;
- (j) **“Contract”**: the undertaking by the parties to perform their respective duties and discharge their obligations as set out in the Contract Documents which represents the entire agreement between the parties;
- (k) **“Contract Documents”**: the documents referred to in the Articles of Agreement and amendments agreed on by the parties in writing;

- (l) **“Contract Price”**: the sum stated in the Articles of Agreement and as may be amended during the progress of the Work;
- (m) **“Contract Time”**: the time stated in the Articles of Agreement, and as may be amended during the progress of the Work, elapsing from the date of commencement of the Work until the date of Substantial Completion of the Work, as certified by the Engineer;
- (n) **“Contractor”**: the party defined as such in the Articles of Agreement;
- (o) **“Day”**: a calendar day;
- (p) **“Engineer”**: the person designated as such in the Articles of Agreement, or such other person designated as such by the City from time to time;
- (q) **“Final Completion”**: when the Work has been performed in accordance with the Contract Documents, as certified by the Engineer;
- (r) **“GC”**: a reference to a clause in these general conditions of this Contract.
- (s) **“Holdback Payment Certificate”**: a certificate issued in accordance with GC 5.6;
- (t) **“Lien Holdback”**: has the meaning given in GC 5.2(a)(i)
- (u) **“Project”**: the total construction of which the Work to be performed under this Contract may be the whole or a part;
- (v) **“Referee”**: the person appointed under GC 9.2(a);
- (w) **“Site”**: the land or actual place designated in the Contract Documents for the performance of the Work;
- (x) **“Subcontractor”**: a party having a direct contract with the Contractor for the performance of any part of the Work, or to supply products worked to a special design for the Work;
- (y) **“Substantial Completion”**: when the Work has progressed to the point where, in the opinion of the Engineer as evidenced by the certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work can be utilized for the intended purpose;
- (z) **“Supplier”**: a party having a direct contract with the contractor to supply products not worked to a special design for the Work;
- (aa) **“Work”**: all or any part of the construction and services required by the Contract Documents, including all labour, materials, equipment and services provided or to be provided by the Contractor to fulfill his obligations under this Contract.

1.2 Documents and Interpretation

- (a) It is the intent of the Contract Documents to include all labour, materials, equipment and services necessary to perform the Work in accordance with the Contract Documents. Any labour, materials, equipment and services that may be reasonably inferred from the Contract Documents or from prevailing custom or

trade usage as being required to produce the intended result, will be furnished and performed by the Contractor, whether or not specifically called for.

- (b) The Contract Documents are complementary, and what is required by one document shall be as binding as if required by all.
- (c) This Contract represents the entire agreement between the City and the Contractor and supersedes all prior negotiations, representations and agreements, either written or oral.
- (d) When words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents and are not otherwise defined, they shall be interpreted in accordance with that meaning.
- (e) The Contract Documents shall not be construed to create a contractual relationship of any kind between:
 - (i) The Engineer and the Contractor, a Subcontractor, a Supplier, a sub-subcontractor or its or their agent or employee, or other person performing any of the Work;
 - (ii) The City and a Subcontractor, a Supplier, a sub-subcontractor or their agent, employee, or other person performing any of the Work, or
 - (iii) Between any persons or entities other than the City and the Contractor.

The Engineer shall however, be entitled to demand performance and enforce the obligations of the parties under this Contract, to facilitate performance of the Engineer's duties.

- (f) Clarifications and interpretations of the Contract Documents shall be issued by the Engineer as provided in GC 4.1.
- (g) In the event of any inconsistency or conflict between provisions of the Contract Documents, the following shall apply:
 - (i) Documents of later date shall govern over earlier documents of the same classification;
 - (ii) Figured dimensions shown on drawings shall govern over scaled dimensions;
 - (iii) Drawings of larger scale shall govern over those of smaller scale;
 - (iv) Specifications shall govern over drawings;
 - (v) The general conditions shall govern over the specifications;
 - (vi) Supplementary general conditions shall govern over the general conditions, and
 - (vii) The Articles of Agreement shall govern over all documents.

- (h) The City shall provide the Contractor with as many sets of Contract Documents as are reasonably required for the performance of the Work.
- (i) The Contractor shall maintain a set of drawings on the Site and record accurately and legibly all deviations caused by Site conditions and written instructions or change orders ordered by the Engineer. The Contractor shall keep one copy of all current Contract Documents and shop drawings on the Site, in good condition. These documents shall be available to the Engineer throughout the duration of the Work.
- (j) All Contract Documents, including copies, and all models furnished by or to the Contractor are and shall remain the property of the City and are not to be used on other work. The Contract Documents are not to be copied or revised in any manner without the City's written consent.
- (k) The division into sections, the table of contents, and the heading in the Contract Documents, other than in the drawings and specifications, form no part of this Contract but are inserted for convenience of reference only.
- (l) Any reference to a statutory provision shall include any subordinate legislation made and from time-to-time amended, extended or re-enacted.
- (m) Unless otherwise indicated, all dollar amounts referred to in this Contract are in lawful money of Canada.
- (n) If any provision of this Contract is determined to be invalid or unenforceable in whole or in part, such invalidity or unenforceability shall attach only to such provision and everything else in this Contract shall continue in full force and effect. In the event any provision of this Contract, as amended from time to time, shall be deemed invalid or void, in whole or in part, by any court of competent jurisdiction, the remaining terms and provisions of this Contract shall remain in full force and effect.
- (o) The schedules, appendices and attachments to this Contract are an internal part of this Contract and a reference to this Contract includes a reference to the schedules, appendices and attachments.
- (p) The language of the specifications and other documents comprising this Contract is in many cases written in the imperative for brevity. Clauses containing instruction, directions or obligations are directed to the Contractor and shall be construed and interpreted as if the words "the Contractor shall" immediately preceded the instructions, directions or obligations.
- (q) Unless the context otherwise requires, wherever used herein the plural includes the singular, the singular includes the plural, and each of the masculine, feminine and neuter genders include all other genders.
- (r) Unless otherwise provided in this Contract, all accounting and financial terms used in this Contract shall be interpreted and applied in accordance with Canadian generally accepted accounting principles, consistently applied from one period to the next.
- (s) References containing terms such as:

- (i) "Hereof," "herein," "hereto," "hereinafter," and other terms of like import are not limited in applicability to the specific provision within which such references are set forth but instead refer to this Contract taken as a whole; and
- (ii) "Includes" and "including", whether or not used with the words "without limitation" or "but not limited to", shall not be deemed limited by the specific enumeration of items but shall in all cases be deemed to be without limitation and construed and interpreted to mean "includes without limitation" and "including without limitation";
- (t) Whenever the terms "will" or "shall" are used in this Contract in relation to the Contractor they shall be construed and interpreted as synonymous and to read "the Contractor shall".

1.3 Notices

- (a) Where a notice is required by the Contract Documents to be given in writing to the Contractor, it may be delivered personally to the Contractor or his site superintendent, or delivered or sent by email, mail or facsimile transmission to the Contractor's address set out in the Articles of Agreement or to his office at or near the Site.
- (b) Where a notice is required by the Contract Documents to be given in writing to the Engineer, it may be delivered personally, or delivered or sent by email, mail or facsimile transmission to the Engineer's address set out in the Articles of Agreement, or to the office of the Engineer at or near the Site.
- (c) Notwithstanding the foregoing provisions of this GC 1.3, each party shall use the most expeditious method of giving the written notice or communication.
- (d) A written notice or communication sent by mail shall be deemed to have been received ten days from the date of posting. Whenever a notice or communication is sent by facsimile transmission, acknowledgement from the receiving party must be given to the other party that the notice or communication has in fact been received, for it to be effective; this acknowledgement may be made verbally, in person or by telephone. If no such acknowledgement is given, it shall be deemed to have been received and be effective ten days from the date the original document was sent.

1.4 Rights and Remedies

- (a) No obligations or responsibilities of any kind by or on behalf of the City shall be implied into the Contract Documents if in the opinion of the Engineer, it is not reasonable under the circumstances to imply that such obligations or responsibilities form part of the Contract Documents.
- (b) Any failure by the City or the Engineer to enforce or to require the strict performance of any of the provisions of this Contract shall not, in any way constitute a waiver of those provisions and affect or impair those provisions or any right the City has at any time to avail itself of any remedies the City may have for any breach of these provisions or to require the Work to be performed in accordance with the Contract Documents.

- (c) Except as expressly provided in the Contract Documents, the duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.

1.5 Assignment

This Contract, or any part of it, or any benefit or interest in it, shall not be assigned by either party without the prior written consent of the other party, which consent shall not be unreasonably withheld. Notwithstanding the foregoing, the City has the right, in the event of any default by the Contractor, to assign all its rights and remedies against the Contractor to the Government of Nunavut.

1.6 Applicable Law

This Contract shall be deemed to have been made in Nunavut and shall be governed by and interpreted in accordance with the laws of Nunavut and the laws of Canada applicable therein.

1.7 Successors and Assigns

This Contract shall ensure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

2. CITY'S OBLIGATIONS

2.1 Payment

Subject to any other provision in the Contract Documents, the City shall make payments to the Contractor at the times and in the manner set out in GC 5.

2.2 Site Availability

- (a) The City shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access to the Site and any other lands designated for the use of the Contractor. The Contractor shall provide and pay for any additional lands and access the Contractor may require, in accordance with GC 3.10(a).
- (b) Except for permits and fees which are the responsibility of the Contractor under GC 3.13, the City shall obtain and pay for necessary approvals, easements and charges required for the development of the Site and for the use or occupancy of permanent structures or for permanent changes in existing facilities.

2.3 Engineer as Representative

- (a) Unless otherwise provided in the Contract Documents, the City shall communicate with the Contractor through the Engineer, and the Contractor shall communicate with the City through the Engineer.
- (b) If the contract with the Engineer is terminated, the City shall promptly appoint a replacement.

2.4 Reference Points

The City shall establish physical reference points for construction on the Site which are, in the opinion of the Engineer, necessary to enable the Contractor to proceed with the Work. The Contractor shall safeguard such reference points in accordance with GC 3.11(b).

2.5 Materials Supplied by the City

Any materials, instructions, information or services required to be supplied by the City under this Contract shall be furnished with reasonable promptness to avoid delay in the orderly progress of the Work.

2.6 Control of the Work

Neither the City nor the Engineer shall supervise or have control or authority over, nor be responsible for, the Contractor's means, methods, techniques or procedures of construction. Neither the City nor the Engineer will be responsible for the Contractor's failure to perform the Work in accordance with the Contract Documents, nor for its failure to comply with Applicable Laws.

2.7 Limitation of Liability

In no event, including without limitation if the City breaches its obligations under this Contract, shall the City be liable to the Contractor, its Subcontractors, sub-subcontractors or any other parties engaged directly or indirectly by or acting on their behalf, for indirect loss, consequential loss, loss of business opportunity or loss of anticipated profit.

3. CONTRACTOR'S OBLIGATIONS

3.1 General Obligation

Notwithstanding any omissions from the Contractor's tender, the Contractor is required to perform all of the Work required by the Contract Documents, including any Work which can be reasonably inferred from them as being necessary to produce the intended result. The Contractor is to perform the Work within the Contract Time, in accordance with the Construction Schedule referred to in GC 3.6.

3.2 Independent Contractor

The Contractor is an independent contractor and shall have complete control of the Work. The Contractor shall effectively direct and supervise the Work to ensure conformance with the Contract Documents. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all parts of the Work, except as may be otherwise specified in the Contract Documents.

Nothing in this Contract shall be construed to mean that the Contractor is an employee, agent or other representative of the City.

3.3 Review of Contract Documents

- (a) By executing this Contract, the Contractor represents that the Contractor has reviewed the Contract Documents and has verified the dimensions, quantities and details described in them. Failure to discover or correct errors, omissions, conflicts or discrepancies which ought to have been discovered by such a review shall not relieve the Contractor from full responsibility for unsatisfactory Work, faulty construction or improper operations resulting therefrom, nor from rectifying such conditions at the Contractor's expense.
- (b) If the Contractor proceeds with the Work in the face of an error, inconsistency or omission that the Contractor discovered, or that a competent Contractor reasonably experienced in the Work would have discovered, without additional instructions from the Engineer, then the Contractor shall at the Contractor's cost remove or replace any incorrectly constructed Work.

3.4 Site Conditions

- (a) By executing this Contract, the Contractor represents that the Contractor is familiar with the conditions under which the Work is to be performed. The Contractor further represents that the Contractor understands the requirements of the Contract Documents and what effects the Site conditions will have on the Work. The Contractor's failure to visit the Site will not excuse the Contractor from the responsibility which otherwise would have been assumed, had the Contractor visited the Site.
- (b) Following the start of the Work, if the subsurface conditions are substantially different from what could reasonably have been expected, based on a reasonable and proper examination of the Site by the Contractor and the information provided in the tender documents, if any, the Contractor must promptly notify the Engineer in writing prior to performing the Work. The Contractor may make a claim for changed site conditions in only accordance with GC 9.1.

3.5 Temporary Structures

The Contractor shall have the sole responsibility for the design, erection, operation, maintenance and removal of temporary structures and other temporary facilities and the design and execution of construction methods required in their use. The Contractor shall engage and pay for professional engineering personnel, registered to practice in Nunavut, skilled in the appropriate discipline, to perform these functions where required by law or by the Contract Documents and in all cases where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

3.6 Schedule

- (a) Within fourteen days of executing the Articles of Agreement and as a condition of the first progress payment, the Contractor shall submit to the Engineer for review, a proposed Construction Schedule showing the anticipated time of commencement and completion of each of the major activities of the Work to be performed. This Construction Schedule shall include the sequence and coordination of the various operations and the estimated time required for the Work and shall provide sufficient detail to permit the Engineer to monitor the

progress of the Work. The Contractor shall revise the proposed Construction Schedule as requested by the Engineer, and the Contractor shall perform the Work in strict adherence to the Construction Schedule, including revisions thereto required by the Engineer, unless it is changed in accordance with the terms of this Contract.

- (b) If at any time it should appear to the Engineer that the actual progress of the Work does not conform to the Construction Schedule, the Contractor shall produce at the Engineer's request, a revised Construction Schedule showing the modifications necessary to ensure completion of the Work in accordance with the previously approved Construction Schedule and shall promptly adopt acceptable additional means and methods of construction, at no cost to the City, which will make up for the time lost and will ensure completion in accordance with the revised Construction Schedule.
- (c) If the Contractor fails or refuses to revise the Construction Schedule as required by this GC, this Contract may be terminated at the City's option, in accordance with GC 10.3.
- (d) The Engineer's review, comments, consent, acceptance or approval to the Construction Schedule shall not relieve the Contractor of any of the Contractor's obligations under this Contract.

3.7 Superintendent

- (a) The Contractor shall assign a competent superintendent and necessary assistants, one or more of whom shall be in attendance at the Site at all times during the progress of the Work. The superintendent and necessary assistants, if any, shall be designated in writing to the Engineer and shall act as the Contractor's authorized representative at the Site. All written or oral communications to the superintendent shall be deemed to have been given to the Contractor. The superintendent shall only be replaced after the Contractor has received written approval from the City.
- (b) The City may order the removal from the Work of any superintendent, supervisor, foreman or other employee who is in the opinion of the City, unfit for the Work, unskilled in the work assigned to him or otherwise unsuitable. Any person so removed shall not be re-employed on the Work by the Contractor or by a Subcontractor.

3.8 Subcontractors

- (a) The Contractor shall not employ any Subcontractor without the approval of the City. Once the names of the proposed Subcontractors have been submitted, the Contractor shall not change these Subcontractors without the advance written consent of the City. If any changes are made without consent, this Contract may be terminated at the City's option, in accordance with GC 10.3.
- (b) The City, through the Engineer, may, at any time during the performance of the Work, object to the use of a Subcontractor and direct the Contractor in writing to employ a different Subcontractor satisfactory to the Engineer.
- (c) The Contractor shall be fully responsible to the City for the acts and omissions of Subcontractors, their agents, employees, and all parties engaged by the

Contractor or its Subcontractors for the provision of work or the supply of materials.

- (d) The Contractor agrees to incorporate the terms of the Contract Documents into all the Contractor's subcontract agreements.
- (e) The Contractor shall maintain good order and discipline among the Contractor's employees and the Subcontractors engaged in the Work. The Contractor shall not employ, or permit Subcontractors to employ, workers who are not skilled in the assigned task. The Contractor shall employ sufficient workers to perform the Work in compliance with the Construction Schedule.

3.9 Other Contractors

- (a) The City reserves the right to let separate contracts with other contractors or workers, or to undertake work using the City's own forces to do other work. If other contractors, workers or the City's own forces are sent onto the Site, with or without plant and material, the Contractor shall, to the satisfaction of the City, grant access to and cooperate with such persons and, in accordance with usual construction practice, coordinate the Work with the other work and connect to other work as specified or shown in the Contract Documents.
- (b) If the sending of other contractors, workers or the City's own forces onto the Site results in a delay in the performance of the Work, which could not have been reasonably foreseen or anticipated by the Contractor when executing the Articles of Agreement, the Contractor may make a claim therefore in accordance with GC 6.2 and 9.1.
- (c) If the Contractor discovers any deficiencies in any other work which might affect the Work, the Contractor shall immediately report such deficiencies to the Engineer and then confirm such report in writing.

3.10 Use of the Site

- (a) The Contractor shall make every effort to confine the Contractor's equipment and plant, storage of materials and operations to limits indicated by the Contract Documents, by a specific direction of the Engineer or by Applicable Laws, and shall not unreasonably occupy the Site. Where the Contractor requires additional land for the erection of temporary facilities and storage of materials, including access to them, the Contractor shall arrange for such and assume all costs and liabilities arising therefrom.
- (b) The Contractor shall not load or permit to be loaded on any part of the Work, a weight or load or force that will endanger its safety or exceed the design loads.
- (c) The Contractor shall not interfere in any way with the work or scheduling of any other contractor, worker or employee of the City. Subject to GC 3.9(b), in order to avoid or minimize such interference, the City may in its absolute discretion, establish schedules or methods and shall notify the Contractor accordingly.

3.11 Survey

- (a) The Contractor shall provide the Engineer with assistance, as required, to make any surveys and measurements, and to establish or check lines and grades.

- (b) The Contractor shall safeguard all points, stakes, grade marks and bench marks made or established on the Work. The Contractor shall bear the expense of re-establishing them and for rectifying Work improperly installed due to the Contractor's failure to safeguard such points, stakes and marks. Additional surveys and staking required by the Contractor to perform the Work, shall be provided by the Contractor at its expense.

3.12 Protection of the Work, Property and the Public

- (a) The Contractor shall be responsible for protecting the Work, the City's property at the Site including the Contract Documents and any plant and material, including plant and material supplied by the City to the Contractor, against loss or damage from any cause but subject to GC 3.15(c). In particular, the Contractor shall take necessary precautions, at the Contractor's expense, to ensure that:
 - (i) No person, adjacent property, right, easement or privilege is injured, damaged or infringed by reason of the Contractor's activities in performing the Work;
 - (ii) Pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the Work;
 - (iii) Fire hazards in or about the Work or the Site are minimized;
 - (iv) Adequate medical services are available to all persons employed on the Work at all times during the performance of the Work;
 - (v) Adequate sanitation measures are taken in respect of the Work; and
 - (vi) All facilities necessary for the purpose of maintaining security are provided, and the Contractor shall assist any person authorized by the City to inspect or to take security measures on the Site.
- (b) The Engineer may order the Contractor to do such things and to perform such additional Work as the Engineer considers reasonable and necessary to ensure compliance with or to remedy a breach of GC 3.12(a) and the Contractor shall comply with the directions of the Engineer, at the Contractor's expense.

3.13 Permits

The Contractor shall procure and post at the Site all permits, certificates and licences required for the construction of the Work and shall be responsible for all fees in respect thereof.

3.14 Applicable Laws

- (a) The Contractor shall perform the Work and give any required notices in full compliance with all Applicable Laws, ordinances, rules, regulations, codes and orders of the municipal and other authorities having jurisdiction which are in or come into force during the performance of the Work.
- (b) The Contractor shall have due regard for the protection of the environment in the performance of the Work and shall not place any materials, including without

limitation, hazardous materials, or dispose of any such materials, or perform any Work in a manner contrary to applicable federal or territorial or municipal environmental laws and regulations, either at the Place of the Work, or at any other place or property.

3.15 Material and Plant Supplied by City

- (a) The Contractor is liable for any loss or damage to material, plant or real property that is supplied or placed by the City in the care, custody and control of the Contractor for use in connection with the Work, whether or not that loss or damage is attributable to causes beyond the Contractor's control.
- (b) The Contractor shall not use any material, plant or real property placed in the Contractor's care, custody and control by the City, except for the purpose of performing the Work.
- (c) The Contractor is not liable to the City for any loss or damage to material, plant or real property if that loss or damage results from and is directly attributable to reasonable wear and tear.

3.16 Equipment, Plant and Material Supplied by Contractor

- (a) Unless otherwise specified in the Contract Documents, the Contractor shall furnish and assume full responsibility for all materials, equipment, labour, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the performance, testing, finishing, start-up and completion of the Work. All materials, equipment, facilities, etc., furnished by the Contractor shall be maintained in a clean and sanitary manner.
- (b) Materials provided shall be new unless otherwise specified in the Contract Documents. Products that are not specified shall be of a quality best suited to their purpose and use, as approved by the Engineer.
- (c) All equipment, plant and material owned by the Contractor and to be incorporated in the Work, from the time of initial delivery to the Site, shall be deemed to be the property of the City; provided always that the vesting of such property shall not prejudice the right of the Contractor to the sole use of the said equipment, plant and material for the purpose of performing the Work nor shall it affect the Contractor's responsibility to operate and maintain the same in accordance with the Contract Documents. The City shall not at any time be liable for the loss of, damage to or risk of loss of any of the Contractor's equipment, plant or materials.

3.17 Workers' Compensation Act

- (a) The Contractor shall comply with, and ensure compliance by all Subcontractors, with the requirements of the *Workers' Compensation Act*, R.S.N.W.T. 1988, c. W-6, as duplicated for Nunavut by s. 29 of the *Nunavut Act*. The Contractor and its Subcontractors shall maintain accounts in good standing with the Workers' Compensation Board. The Contractor shall provide verification from the Workers' Compensation Board that the Contractor's account is in good standing prior to the release of holdbacks, at the end of the warranty period and as requested by the Engineer. The City may refuse to make a payment to the Contractor unless

the Contractor furnishes evidence from the Workers' Compensation Board that the Contractor's account is in good standing.

- (b) If the City receives a notice from the Workers' Compensation Board that the Contractor's accounts, or any Subcontractors' accounts are not in good standing, or if a demand for payment is received, the City may suspend payments due to the Contractor until a letter of clearance is obtained or the City has paid the amount on behalf of the Contractor.
- (c) If the City is required to pay any amount to the Workers' Compensation Board on behalf of the Contractor, or any Subcontractor, the City may deduct the amount from any amount owing to the Contractor under this or any other contract, or may demand a reimbursement by the Contractor to the City for the amount paid by the City.
- (d) If at any time the performance of the Work is stopped because the Contractor unreasonably fails or refuses to comply with a regulation or order issued pursuant to the *Workers Compensation Act*, R.S.N.W.T. 1988, c. W-6, as duplicated for Nunavut by s. 29 of the *Nunavut Act*, then such failure or refusal shall be considered a default under this Contract, and this Contract may be terminated at the City's option, in accordance with GC 10.3.

3.18 Occupational Health and Safety

- (a) The Contractor shall be solely responsible for construction safety at the Site as and to the extent required by the *Safety Act*, R.S.N.W.T. 1988, c. S-1, as duplicated for Nunavut by s. 29 of the *Nunavut Act* other applicable construction safety legislation, regulations and codes, any City safety Policies, as amended from time to time, and by good construction practice.
- (b) In any case where, pursuant to the provisions of the *Safety Act*, R.S.N.W.T. 1988, c. S-1, as duplicated for Nunavut by s. 29 of the *Nunavut Act*, the Director of Inspections or a Safety Officer orders the Contractor or any Subcontractor performing the Work, to cease work because of failure to install or adopt safety devices directed by the regulations made under the said Act, or required by it, or because the Director of Inspections or a Safety Officer is of the opinion that conditions of immediate danger exist that would likely result in injury to any person, the City may exercise its right to terminate this Contract or suspend the Work immediately, in accordance with GC 10, until the default or failure is corrected.

3.19 Cutting and Patching

- (a) The Contractor shall do all cutting, fitting or patching of the Work that may be required to tie in properly with the work of other contractors shown in, or reasonably inferable from the Contract Documents.
- (b) The Contractor shall not endanger any existing Work by cutting, patching or otherwise, and shall not cut or alter the work of any other contractor save with the consent of the Engineer and then only to the extent permitted by the Engineer.
- (c) The Contractor shall not unreasonably withhold from the City or a separate contractor the Contractor's consent to cutting or otherwise altering the Work in accordance with any direction given by the Engineer.

3.20 Defective Work

- (a) Defective work, whether the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the Contractor or any Subcontractor, and whether incorporated in the Work or not, which has been rejected by the Engineer as failing to conform to the Contract Documents, shall be removed promptly from the Work and replaced or re-executed by the Contractor in accordance with the Contract Documents, at the Contractor's expense.
- (b) Where any part of the Work is damaged by such removals, replacements or re-execution, it shall be made good, promptly, at the Contractor's expense.
- (c) Where the Contractor fails to correct defective or rejected work within the time limits specified by the Engineer, the City may correct defective or rejected Work and deduct the cost of same from the Contract Price, or may terminate this Contract in accordance with GC 10.3.
- (d) In cases of emergency, the City may take whatever action it deems necessary to correct defective or rejected Work and deduct the cost of same from the Contract Price.
- (e) If, in the opinion of the Engineer, it is not expedient to correct defective work or work not done in accordance with the Contract Documents, the City may deduct from the Contract Price the difference in value between the Work as done and that required by this Contract, as determined and certified by the Engineer.

3.21 Testing and Inspection

- (a) Unless otherwise specified in the Contract Documents, the Contractor shall not rely on the City's testing program, for the Contractor's own quality control, but shall perform such testing as may be required to ensure that the Work complies in all respects with the Contract Documents.
- (b) The Contractor shall promptly provide the Engineer with two copies of all certificates, inspection and testing reports required by the Contract Documents or ordered by the Engineer.
- (c) The Engineer may conduct quality control testing regarding the acceptability of materials used in the Work and the Contractor shall furnish for the Engineer's approval such samples as the Engineer may reasonably require, at the Contractor's expense.
- (d) The Engineer may order retesting of questioned Work. If such retesting shows the Work to comply with the provisions of this Contract, the City shall pay the cost of retesting. If the retesting shows that through the fault of the Contractor the Work does not so comply, the Contractor shall pay all associated costs. Testing which is paid for by the City shall not be subject to direction or control by the Contractor.

- (e) The Engineer shall at all times have access to the Work and the Contractor shall provide proper facilities for such access and for inspection. If any Work should be covered without the approval or consent of the Engineer, it must, if required by the Engineer, be uncovered for examination and subsequently recovered, both at the Contractor's expense.
- (f) Any inspection of the Work by the Engineer or the failure of the Engineer to make any inspection, or:
 - (i) The thoroughness or lack of thoroughness of any inspection made by the Engineer;
 - (ii) The failure of the Engineer to observe defective workmanship or materials either by the Contractor or a Subcontractor;
 - (iii) The failure to direct the attention of the Contractor or Subcontractor, or of any other person, to the inadequacy of the manner in which this Contract is being performed, or
 - (iv) The inadequacy or insufficiency of any equipment or material used in the performance of or incorporated in the Work,

Shall not relieve the Contractor from the responsibility for any failure to supply materials and complete the Work strictly in accordance with the Contract Documents.

3.22 Site Cleanliness

- (a) The Contractor shall maintain the Site in a tidy condition and free from the accumulation of waste material and debris, to the satisfaction of the Engineer.
- (b) Before the issuance of a certificate of Substantial Completion, the Contractor shall remove all the Contractor's plant and material not required for the remaining Work, and all waste material and other debris, and shall ensure that the Work and the Site are clean and suitable for occupancy or use by the City, unless otherwise directed by the Engineer.
- (c) Before the issuance of a certificate of Final Completion, the Contractor shall remove from the Site all the Contractor's plant and material and any waste material and other debris, to the satisfaction of the Engineer.
- (d) If the Contractor fails or refuses to remove all such plant, materials, equipment and waste within a reasonable time after achieving Final Completion then, on written notice from the Engineer to the Contractor specifying a reasonable time to remedy such failure or refusal, the City may do or cause to be done the removal and all reasonable resulting costs incurred by the City may be deducted from any amounts owing by the City to the Contractor.

- (e) The Contractor's obligations described above do not extend to waste material and other debris caused by the City's agents or other contractors.

3.23 Claims Against and Obligations of the Contractor

- (a) The Contractor shall pay out and discharge all its lawful obligations and shall satisfy all lawful claims against it arising out of the performance of the Work at least as often as this Contract requires the City to pay the Contractor.
- (b) The Contractor shall, in accordance with the Contract Documents and whenever requested to do so by the Engineer, make a statutory declaration regarding the existence and condition of any obligations of and claims against the Contractor, any Subcontractors, or Suppliers. Upon request by the City, the Contractor shall provide letters from its Subcontractors and Suppliers regarding the status of any accounts with the Contractor and the details of any claims, if any.
- (c) The City may, in its absolute discretion, and at any time prior to the final release of holdbacks, in order to discharge lawful obligations of and satisfy lawful claims against the Contractor, any Subcontractors, Suppliers or any sub-subcontractors, arising out of the performance of the Work, pay any amount that is due and payable to the Contractor pursuant to this Contract, directly to the obligees of and the claimants against, the Contractor, Subcontractor, Supplier or sub-subcontractor. When the parties involved in the claim are in agreement on the validity and amount of the claim, the City may treat this as a lawful claim.
- (d) Where no agreement is reached between the parties as referred to above, the City may withhold payment, without any obligation to pay interest, until the validity and amount of the Claim is established by legal proceeding. The City may, in its absolute discretion, bring the matter before the Nunavut Court of Justice by way of Interpleader, and shall dispose of the funds withheld in accordance with the direction of the Court.
- (e) A payment made pursuant to this provision is, to the extent of the payment, a discharge of the City's liability to the Contractor under this Contract and may be deducted from an amount payable to the Contractor under this Contract.

3.24 Patent Rights

The Contractor shall indemnify the City from and against all claims, liabilities and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of the Contractor's equipment, materials or plant used for or in connection with, or for incorporation into the Work, and from and against all damages, costs, charges and expenses whatsoever relating thereto.

3.25 Royalties

Except where otherwise stated, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for obtaining building materials required for the Work.

3.26 Records to be Kept by Contractor

- (a) The Contractor shall maintain complete records of the Contractor's estimated and actual costs of the Work together with all tender calls, quotations, contracts,

correspondence, invoices and receipts. In accordance with the terms of this Contract, these documents shall be available for audit and inspection by the City or by persons acting on behalf of the City when requested. The Contractor shall furnish any such person with any information it may require from time to time in connection with these records.

- (b) Records maintained by the Contractor shall be kept intact for six years following the end of the warranty period or such other period of time as directed by the Engineer.
- (c) The Contractor shall ensure that all of its Subcontractors comply with the above requirements.

3.27 Public Ceremonies and Signs

- (a) The Contractor shall not permit any public ceremony in connection with the Work without the prior written consent of the City.
- (b) The Contractor shall not erect or permit the erection of any sign or advertising on the Site without the prior written consent of the City.

3.28 Non-Compliance by Contractor

- (a) If the Contractor fails to comply, within a reasonable time, with any decision or direction given by the Engineer, the City may employ such methods as the City deems advisable to do that which the Contractor failed to do.
- (b) The Contractor shall pay the City the total of all costs, expenses and damages incurred or sustained by the City by reason of the Contractor's failure to comply with any decision or direction referred to above, including the cost of any method employed by the City. Where the amounts owing to the Contractor under this Contract are insufficient to cover such costs, the Contractor shall pay the balance to the City immediately.

4. ADMINISTRATION BY ENGINEER

4.1 Engineer's Duties and Authority

- (a) The Engineer will administer this Contract on behalf of the City as provided in the Contract Documents.
- (b) The Engineer will be the City's representative until the Work has been completed in accordance with the Contract Documents.
- (c) Except as expressly stated in the Contract Documents, the Engineer shall have no authority to relieve the Contractor of any of the Contractor's obligations under this Contract.
- (d) The Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work performed and shall deal with Claims as they arise, in accordance with GC 9.1.

- (e) If any error, inconsistency, or omission in the Contract Documents is discovered, the Engineer shall provide directions or clarifications to the Contractor.
- (f) During the progress of the Work, the Engineer shall have authority to reject Work that, in the Engineer's opinion, does not conform with the requirements of the Contract Documents, or to issue written additional instructions regarding the Work which may, in the opinion of the Engineer, be necessary to supplement or clarify the Contract Documents. Such additional instructions shall be consistent with the intent of the Contract Documents, shall not entitle the Contractor to an Adjustment and shall be binding upon and be carried out promptly by the Contractor.
- (g) Wherever, under this Contract, the Engineer is required to exercise discretion by:
 - (i) rendering a decision, opinion or consent;
 - (ii) expressing satisfaction or approval;
 - (iii) determining value; or
 - (iv) otherwise taking action which may affect the rights and obligations of the City or the Contractor,

the Engineer shall do so impartially, consistent with the terms of this Contract and having regard to all of the circumstances. Any such decision, opinion, consent, expression of satisfaction or approval, determination of value or action, may be opened up, reviewed or revised as provided in GC 9.

4.2 Observing the Work

The Engineer will visit the Site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. However, the Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of such on-site observations, the Engineer will keep the City informed of the progress of the Work, and will endeavour to guard the City against defects and deficiencies in the Work.

4.3 Engineer's Decision

Except as provided in GC 4.1(g), neither the Engineer's authority or responsibilities under GC 4 or under any other provision of the Contract Documents nor any decision made by the Engineer in good faith either to exercise or not exercise such authority or responsibility, shall create, impose or give rise to any duty or responsibility owed by the Engineer to the Contractor, any Subcontractor, Supplier, or to any surety for or employee or agent of any of them.

5. PAYMENT AND COMPLETION

5.1 Progress Payments

- (a) At the end of each calendar month, or such other period as is agreed to between the Engineer and the Contractor, the Contractor shall deliver to the Engineer a written progress claim that describes the Work that has been completed and any material that was delivered to the Site but not yet incorporated into the Work since the last progress claim.
- (b) The Engineer shall, within fourteen days of receipt of the Contractor's progress claim, review the claim and prepare a certificate for payment which may take the form of an endorsement on the progress claim. If the Engineer amends the progress claim, he will promptly notify the Contractor in writing, giving reasons for the amendment.
- (c) Where the Contractor does not submit a progress claim or where the Engineer does not endorse the Contractor's progress claim, the Engineer may calculate the progress payment and prepare a certificate for payment by the City. Where unit prices apply, payment will be calculated on the basis of the unit prices specified in the Contract Documents and the units of Work completed as determined by the Engineer. Where a lump sum price applies, payment will be calculated on the basis of the Engineer's estimate of the percentage of the Work completed.
- (d) The progress certificate will show, to the end of the period covered by the progress claim, the estimated value of all labour and materials incorporated into the Work, GST monies paid, all materials stored at the Site and all Change Orders certified by the Engineer. The certificate shall also show the aggregate of previous payments and the amounts withheld. The gross amount shown on such certificate, less the aggregate of all payments to date and sums withheld, shall become due and be payable by the City to the Contractor within thirty days following receipt by the City of the progress certificate.
- (e) The estimates referred to above shall not bind the City or the Engineer in any manner in the preparation of the final estimate of the Work done, but shall be held to be approximate only and shall in no case be taken as an acceptance of the Work or as a release of the Contractor from the Contractor's responsibilities under this Contract.
- (f) If for any reason the City disputes the net amount shown for payment on a progress certificate the City shall, within the time specified in this GC, pay to the Contractor any amount not disputed and also deliver to the Contractor and the Engineer written reasons for any deductions.

5.2 Contract Holdbacks

- (a) The City will retain Contract holdbacks in accordance with the following:
 - (i) Ten percent from each progress payment made prior to the issuance of the first Holdback Payment Certificate by the Engineer (the "Lien Holdback"), and

- (ii) Five percent from any payments made to the Contractor following the issuance of the first Holdback Payment Certificate, other than from holdback payments.

5.3 Substantial Completion

- (a) When the Contractor considers the Work ready to be utilized for its intended purpose, the Contractor may apply in writing to the Engineer to issue a certificate of Substantial Completion. The Contractor shall prepare and submit with its application a comprehensive list of items to be completed or corrected, a statutory declaration as per GC 3.23(b) and particulars of, or a waiver of, all outstanding claims against the City, arising out of the Work. The Contractor shall proceed promptly to complete and correct the items on the list. Failure to include an item on this list does not alter the Contractor's responsibility to complete the Work in accordance with the Contract Documents.
- (b) Following the receipt of an application from the Contractor for a certificate of Substantial Completion, the Engineer shall, with reasonable promptness, make an inspection and assessment of the Work. Within seven days of the inspection, the Engineer shall notify the Contractor of his approval, or reasons for, disapproval of the application. If the Engineer determines that the Work is substantially completed, he shall issue a certificate of Substantial Completion to the City and the Contractor. A list of items to be completed or rectified shall accompany the certificate. If the Engineer does not consider the Work to be substantially completed, he shall notify the Contractor in writing of the reasons why and list the items to be completed or rectified, of which the Engineer is aware.
- (c) The City may deduct from the Contract Price, or any amounts due to the Contractor, the costs associated with the Engineer being called upon to perform more than one inspection for the purpose of determining Substantial Completion, when in the opinion of the Engineer, the Work was clearly not yet substantially complete.
- (d) The certificate of Substantial Completion shall establish the date of Substantial Completion and shall fix the time within which the Contractor shall complete or correct all items on the list accompanying the certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion, unless otherwise provided, in the certificate of Substantial Completion.
- (e) Similarly, in accordance with the procedure set out above, the Engineer may in its absolute discretion, issue a certificate of Substantial Completion in respect of any part of the Work which has been both completed to the satisfaction of the Engineer and which the City has elected to occupy or use prior to completion.
- (f) In addition to other holdbacks as provided by the Contract Documents, when considering Substantial Completion, the City may hold back from payments otherwise due to the Contractor the amount that is two times of the amount of a reasonable estimate, as determined by the Engineer, on account of deficient or defective Work already paid for. This holdback may be held, without interest, until such deficiency or defect is remedied. The items of defect or deficiency and the amounts of related holdback shall be listed separately on the payment certificate.

5.4 Final Completion

- (a) Following Final Completion of the Work, including any testing, the Contractor shall provide the Engineer with the following:
 - (i) A statutory declaration as referred to in GC 3.23(b) that:
 - (A) The Work has been completed in accordance with the Contract Documents; and
 - (B) No claims exist or alternatively setting out the particulars of any claims relating to personal injury or death or property loss or damage arising out of the Work, and any alleged infringement by the Contractor of a patent or other property right in performing this Contract; and
 - (ii) Particulars of, or a waiver of, all outstanding claims against the City, arising out of the Work.
- (b) Following receipt of the documents referred to in GC 5.4(a), the Engineer shall, with reasonable promptness, conduct an inspection and assessment of the Work to verify that the Work has been completed in accordance with the Contract Documents. Within fourteen days of receipt of the above documents, the Engineer shall either issue a certificate of Final Completion to the City and the Contractor or a list of items to be completed or rectified, of which the Engineer is aware. The City may deduct from monies owed to the Contractor the costs associated with the Engineer being called upon to perform more than one inspection.
- (c) Receipt by the Contractor of the certificate of Final Completion shall entitle the Contractor to payment in accordance with GC 5.5.

5.5 Final Progress Payment

- (a) The final progress payment certificate will be prepared following the issuance of the certificate of Final Completion. The final progress payment certificate will show the total amount payable to the Contractor, less any amounts retained.
- (b) The final progress payment amount shall be paid by the City to the Contractor within thirty days following receipt by the City of the final progress payment certificate.

5.6 Holdback Release

- (a) Forty-five days following the date of the issuance of the certificate of Substantial Completion by the Engineer, the Contractor may apply to the City for release of fifty percent of the Lien Holdback. The Contractor shall with such application provide the Engineer with a statutory declaration as referred to in GC 3.23(b), with the content referred to in GC 5.4(a)(i), and the particulars of a waiver of, all outstanding claims against the City, arising out of the Work. The Engineer shall, within fourteen days' receipt of the Contractor's application, issue a Holdback Payment Certificate or a list of items to be rectified prior to payment.

- (b) Following the release of fifty percent of the Lien Holdback in accordance with GC 5.6(a), the Contractor may apply in writing for release of the remainder of all Contract lien holdback funds retained by the City, provided an irrevocable letter of credit, in a form acceptable to the City and from a bank and branch acceptable to the City, for the same amount is presented for the City's consideration. The City may, in its absolute discretion, accept or reject the Contractor's irrevocable letter of credit in place of the remainder of all Contract holdback funds.
- (c) The irrevocable letter of credit referred to in this provision must be for the same amount as the remainder of all Contract lien holdback funds and must remain in place until expiry of the warranty period referred to in GC 11.4. Should the Contractor's irrevocable letter of credit be scheduled to expire prior to the end of such warranty period, the City may, at any time within the fourteen days prior to the expiry date, call upon and draw down the irrevocable letter of credit, unless the Contractor presents a renewal thereof with an expiry date beyond the warranty period.
- (d) One year following the date of the issuance of the Certificate of Substantial Completion by the Engineer, the Contractor may apply to the City for release of the remainder of all Contract holdbacks or the return of irrevocable letters of credit, if any. The Engineer shall, within fourteen days of receipt of the Contractor's application, issue a Holdback Payment Certificate or a list of items to be rectified prior to payment.
- (e) The City may withhold from monies owing to the Contractor, an amount equal to the Engineer's estimate of the value of all outstanding deficiencies.
- (f) Subject to any applicable lien legislation requirements, holdback payments shall become payable or irrevocable letters of credit shall be returned by the City to the Contractor, within thirty days following receipt by the City of the Holdback Payment Certificate.

5.7 Delay in Making Payment

- (a) Delay by the City in making payments when they are due pursuant to this provision shall not be a breach of this Contract by the City.
- (b) Unless otherwise stated in this Contract, when the City delays in making a payment that is due pursuant to this clause, the Contractor shall be entitled to receive simple interest on the amount that is overdue, at the prime lending rate of the main banker of the City.

5.8 Right of Set-off

Without limiting any right of set-off or deduction given or implied by law or elsewhere in the Contract Documents, the City may set-off any amount payable to the City by this Contractor against any amount payable to the Contractor under this Contract.

6. TIME AND DELAYS

6.1 Time of the Essence

Time is of the essence of this Contract, including without limitation the dates and time limits stated in the Contract Documents. By executing this Contract, the Contractor confirms that this Contract Time is a reasonable period for performing the Work.

6.2 Delays

- (a) Where a delay occurs in the progress of the Work and:
 - (i) The delay is attributable to or within the control of the Contractor or its Subcontractors, or was reasonably foreseeable by them at the time this Contract was entered into, the Completion Date will not be adjusted. The Contractor will be liable to the City for all costs and expenses incurred by the City, as well as for any losses resulting from the City's inability to utilize the Work for its intended purpose resulting from the delay, and the City may deduct such costs from payments owing to the Contractor under this Contract;
 - (ii) The delay is due to an act or neglect by the City, the Engineer, or other contractor, or of an employee of any of them, then the Contractor may make a Claim therefore, in accordance with GC 9.1, or
 - (iii) The cause for the delay does not fall within the circumstances described in (i) or (ii) above, the Contractor may make a Claim for an Adjustment in the Contract Time (but not for an Adjustments of the Contract Price), in accordance with GC 9.1. This shall be the Contractor's sole and exclusive remedy for such delays.
- (b) In no event will adverse weather be considered to be a cause of delay beyond the Contractor's or its Subcontractors' control or not reasonably foreseeable by them at the time this Contract was entered into.

7. ASSESSMENTS AND DAMAGES FOR LATE COMPLETION

7.1 Late Completion

- (a) For the purposes of this General Condition, "period of delay" means the number of days commencing on the Completion Date fixed by the Articles of Agreement and ending on the day immediately preceding the day on which the certificate of Substantial Completion is issued but does not include any day within a period of extension granted pursuant to GC 9.1 and 6.2, or any other day on which, in the opinion of the Engineer, completion of the Work was delayed for reasons beyond the control of the Contractor.
- (b) If the Contractor does not complete the Work by the Completion Date but completes it thereafter, the Contractor shall pay the City an amount equal to the aggregate of:

- (i) all salaries, wages, and travelling expenses incurred by the City in respect of persons overseeing the performance of the Work during the period of delay;
- (ii) the cost incurred by the City as a result of the liability to use the completed Work for the period of delay; and
- (iii) all other expenses and damages incurred or sustained by the City during the period of delay as a result of the Work not being completed by the Completion Date.

8. CHANGE ORDERS

8.1 Changes in the Work

- (a) Without invalidating this Contract, the City may, through the Engineer, direct in writing the Contractor to make changes in the Work by adding to, deleting from or revising the Work.
- (b) When no Change Order has been issued by the Engineer, and the Contractor claims that any of the Work being performed or proposed constitutes a change in the Work entitling the Contractor to an Adjustment, the Contractor may make a Claim therefore in accordance with GC 9.1.
- (c) Changes in the Work directed by the City shall not be initiated, and shall not be carried out by the Contractor, without the prior written authorization of the City through the Engineer.
- (d) Upon receipt of a Change Order from the Engineer, the Contractor shall promptly proceed with the Work involved under the applicable provisions of the Contract Documents, except as specifically provided in the Change Order.
- (e) The Engineer may in writing direct the Contractor to proceed with the Change notwithstanding that a Change Order has not been prepared or agreed at the time of such direction, and upon receipt of such direction the Contractor shall promptly proceed with the Work as aforesaid. If the parties fail to agree upon the price for such Change, the price therefore shall be as set out in GC 8.2(f) or (i), as applicable.
- (f) If notice of any change in the Work is required by the provisions of any bond to be given to a surety, the Contractor will be responsible for giving such notice, and the amount of each applicable bond shall be adjusted accordingly. For the purposes of this provision, the Contractor will be considered to be the surety's agent.

8.2 Valuation of Changes

- (a) When a change results in a decrease in the Work, the Contract Price shall be decreased by an amount to be determined by the Engineer, with such decrease valued in the same manner as if it were an increase.
- (b) When a change causes an increase in the Work, the Contract Price shall be increased in accordance with this provision.

- (c) If this Contract specifies unit prices for changes to the Work, and the Engineer concurs in their use on a particular change or portion thereof, then the Contractor shall be paid for such change or portion, a sum determined by applying the unit prices to the actual quantum, as measured by the Engineer, determined after completion of the Change.
- (d) Where this Contract specifies force account rates for labour, equipment and materials, and the Engineer concurs in their use on a particular change or portion thereof, then the Contractor shall be paid for such change or portion, a sum determined by applying the force account rates to the number of hours of labour and equipment expended and quantities of materials utilized. The Contractor shall present records of the work done to the Engineer for approval, at the times and in the manner specified by the Engineer.
- (e) If there are changes, or portions of changes, for which unit prices or force account rates are not applicable or specified, then the Contractor shall propose to the Engineer a fixed price for such changes or portions. Upon agreement by the City on the amount thereof, the proposed fixed price shall become the sum the Contractor shall be paid for such change or portion.
- (f) If the Contractor and the City are unable to agree on a fixed price, then the Contractor shall be reimbursed its costs for performing the changes as directed by the Engineer, consistent with the following:
 - (i) Wages, salaries and travelling expenses of the Contractor's employees while actually engaged on the Work, excluding any and all expenses of head office personnel;
 - (ii) Workers' compensation assessments, unemployment insurance premiums, pension plan payments and paid holidays;
 - (iii) Rental cost of machinery and equipment that is used in the performance of the Work, or an allowance for depreciation if owned by the Contractor;
 - (iv) Operation and maintenance costs for machinery and equipment used in the performance of the Work, other than costs of repairs arising out of defects existing before it was brought on to the Site;
 - (v) Cost of materials necessary for and incorporated into the Work or consumed in the performance of the Work;
 - (vi) Cost of premiums for all bonds and insurance;
 - (vii) Other expenses incurred by the Contractor as approved in advance by the Engineer for the proper performance of the Work;
 - (viii) Subcontractor costs calculated in accordance with GC 8.2(f) (i to vii) above; and
 - (ix) An allowance for profit and all other expenditures or costs, including overhead, general administration costs, financing and interest charges, and every other cost, charge and expense, in an aggregate amount that is equal to twenty percent of the expenses referred to in GC 8.2(f) (i to

vii), And equal to ten percent of the expenses referred to in GC 8.2(f) (viii) above.

- (g) Whenever the cost of any Work is to be determined in accordance with GC 8.2(f), the Contractor will establish and maintain records in accordance with GC 3.26.
- (h) Pending final determination of cost, amounts not in dispute shall be included in progress payments.
- (i) If the method of valuation of any increase cannot be promptly agreed upon, the Engineer shall determine the method of valuation and issue a written authorization for the change setting out the method of valuation.

8.3 Contingency Allowance

- (a) The Contract Price includes the contingency allowance, if any, stated in the Contract Documents.
- (b) Expenditures under the contingency allowance shall be authorized in the same manner as for a Change Order in accordance with GC 8, and the value shall be determined in accordance with GC 8.2.
- (c) The unexpended portion of the contingency allowance shall be credited to, and paid to, the City as a condition of achieving Substantial Completion, unless otherwise agreed to by the City.

9. DISPUTE RESOLUTION

9.1 Engineer's Decision

- (a) Where a Claim arises out of, or in connection with this Contract or the performance of the Work, whether during the performance of the Work or after its completion and whether before or after termination of this Contract, the Claim shall, in the first place, be referred in writing to the Engineer in accordance with this provision.
- (b) A written notice stating the general nature of the Claim shall be delivered by the party making the Claim to the other party and to the Engineer promptly, and in no event later than seven days after the occurrence of the event giving rise to the Claim. Any Work for which a Claim has been made, shall be kept readily accessible and shall not be covered up without the express permission of the Engineer.
- (c) Notice of the extent of the Claim with supporting data shall be delivered within fourteen days after such occurrence. The Contractor shall keep contemporaneous records as may reasonably be necessary to support the Contractor's Claim, which may be inspected by the Engineer, as he deems necessary.
- (d) The Engineer shall review the information submitted, consult with the parties and make reasonable efforts to obtain agreement between the City and the Contractor regarding the Claim. The parties agree that, both during and after the performance of the Work, each of them shall use their best efforts to resolve any

disputes arising between them by amicable negotiations, and shall provide frank, candid and timely disclosure of all relevant facts, information and documents to facilitate those negotiations. The Engineer may request the parties to refer the matter to more senior levels of management within their organizations, in an effort to resolve the Claim.

- (e) Where the City and the Contractor reach an agreement on the Claim, the Engineer will, where appropriate, prepare a Change Order for the City's approval, which shall be sufficient to effect a change in this Contract, in accordance with the terms of the Change Order and the Contract Documents.
- (f) If the City and the Contractor cannot reach an agreement regarding the Claim, the Engineer shall decide the matter and notify the parties in writing of his decision, within fourteen days of the last submission, and in no event later than thirty days following the date of the occurrence giving rise to the Claim. Valuation of Adjustments in the Contract Price shall be determined by the Engineer in accordance with GC 8.2.
- (g) Unless this Contract has already been terminated, the Contractor shall, in every case, proceed with the Work with all due diligence and the City and the Contractor shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided.
- (h) Where either party disputes the decision of the Engineer or where the Engineer fails to notify the parties of his decision in accordance with GC 9.1(f) then either party may, within fourteen days, notify the other party of its intention to refer the matter to the Referee in accordance with GC 9.2 or Arbitrator in accordance with GC 9.3, as application. No referral may be made unless such notice is given. Notices shall be copied to the Engineer for information.
- (i) If the Engineer has given notice of his decision as to a matter in dispute to the parties and no notice of intention to refer the matter to the Referee has been given by either the City or the Contractor within thirty days, the Engineer's decision shall become final and binding upon the parties.
- (j) No act by the claimant shall be construed as a renunciation or waiver of any of its rights or recourses provided the claimant has given the required notices and carried out the instructions specified. The presentation of a Claim shall not be grounds for delay or interruption of the Work.

9.2 Appointment of Referee

- (a) If the City and the Contractor agree to appoint a Referee, the City and the Contractor shall name, within thirty days of the parties signing this Contract, a Referee who may be called upon during the performance of, or after the completion of the Work, to settle any Claims or disputes arising under this Contract. Where the Referee appointed in accordance with this provision refuses to act, is incapable of acting or dies, the parties shall name a new Referee at the earliest opportunity. Should the parties be unable to agree on a Referee within the time specified, the Engineer whose decision shall be final, shall name a Referee.
- (b) Where either party has disputed a decision of the Engineer in accordance with GC 9.1(h), the Referee shall review the decision of the Engineer and may, if he

deems it appropriate, require the parties to supply him with further information or documentation, giving each party an opportunity to respond. The Referee may inspect the Work after giving reasonable notice to each party of the time he intends to do so.

- (c) Not later than thirty days after receipt of the last documentary submission, where the matter has not been resolved in accordance with GC 9.2(b), the Referee shall issue his written decision with reasons to the parties.
- (d) The costs of retaining the Referee shall be shared equally between the City and the Contractor, unless the Referee directs otherwise. The City may deduct such costs assessed against the Contractor by the Referee, from any amount due and payable by the City to the Contractor under this Contract.

9.3 Appointment of Arbitrator

- (a) If the parties agree to appoint a Referee, then within fourteen days after the Referee has rendered his decision, either party may, by written notice to the other party and to the Engineer for information, refer the decision of the Referee to arbitration pursuant to this GC 9.3. If the parties have not agreed to appoint a Referee, then within the fourteen day period referred to in GC 9.1(h), either party may refer to decision of the Engineer to arbitration pursuant to this 9.3. Upon any such referral, the parties shall appoint a single Arbitrator, for arbitration in accordance with the *Arbitration Act*, R.S.N.W.T. 1988, c. A-5, as duplicated for Nunavut by s. 29 of the *Nunavut Act*, subject to the following provisions:
 - (i) The Arbitrator shall have the authority to call upon the Referee to give evidence during the arbitration proceedings, including all documentation prepared by the Referee or reviewed by him;
 - (ii) The decision of the Arbitrator shall be final and binding upon the parties who covenant that their disputes shall be so decided by arbitration alone and not by recourse to any court by way of action at law;
 - (iii) Arbitration proceedings may be commenced prior to or after completion of the Work, provided that the obligations of the City, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the Work;
 - (iv) Before the arbitration proceeds on the substantive issues, a budget for the proceedings shall be established by the Arbitrator and each party shall deposit, as security for costs, a sum equal to half of such budget with the Arbitrator, who shall thereupon deposit such funds in an interest bearing trust account with a chartered bank. Subject to the award and payment of costs as hereinafter provided, the balance of the security deposits and interests shall be properly returned to the respective parties; and
 - (v) The cost of arbitration may be awarded against the parties hereto or against any one of them as the Arbitrator may decide.
- (b) If a Claim involves the Work of a Subcontractor, either the City or the Contractor may join such Subcontractor as a party to the arbitration between the City and the Contractor. The Contractor shall include in all its subcontracts specific

provision whereby its Subcontractors consent to being joined in an arbitration between the City and the Contractor involving the Work of such Subcontractors. Nothing in this provision nor in the provision of such subcontracts consenting to joinder shall create any claim, right or cause of action in favour of the Subcontractors as against the City or the Engineer, that does not otherwise exist.

- (c) If no notice is received within the time limits set out or referred to in GC 9.3(a), the decision of the Referee shall be final and binding on the parties.
- (d) The Contractor agrees that it shall join other arbitration proceedings with respect to the Project, as requested in writing by the City.

9.4 Adherence to Provisions

- (a) The provisions, including without limitation, procedure and sequences, outlined in GC 9.1 to 9.3 for the resolution of disputes shall be strictly adhered to by both parties.

10. WITHDRAWAL, SUSPENSION AND TERMINATION

10.1 Withdrawal of the Work

- (a) After giving the Contractor seven days written notice within which the Contractor may remedy any delay or default specified, the City may, through the Engineer, withdraw the Work from the Contractor where the Contractor is not diligently performing the Work to the satisfaction of the Engineer or has not completed the Work within the time specified in this Contract.
- (b) On withdrawal of the Work, the City may:
 - (i) Take possession of all plant, equipment and materials on the Site and ordered by the Contractor for the Work but not yet delivered to the Site; and
 - (ii) Complete the Work withdrawn from the Contractor.
- (c) Withdrawal of the Work by the City does not terminate this Contract and does not relieve the Contractor of its obligation to complete the remainder of the Work.
- (d) The Contract Price will be reduced by the value of the Work withdrawn, as determined by the Engineer. The Contractor shall be liable to the City for all extra costs incurred by the City to complete the Work withdrawn from the Contractor, including all amounts set out in GC 10.3(d) notwithstanding that the Contractor may not be in default hereunder, and the City may deduct such costs from payments owing to the Contractor under this Contract.

10.2 Suspension of the Work

- (a) The City may through the Engineer suspend the progress of the Work at any time by giving the Contractor a written notice, which shall include the reason for the suspension.

- (b) Where such a suspension results in a delay in the progress of the Work, the rights of the parties shall be determined in accordance with GC 6.2(a)(i), (ii) or (iii) as applicable, and shall be based on the reason for the suspension.
- (c) During the period of suspension, the Contractor shall protect, preserve and maintain the Work in a manner satisfactory to the City and shall not remove any part of the plant, equipment and materials from the Site without the prior written consent of the City.
- (d) Following the suspension, the Construction Schedule shall be revised by the Contractor, for approval by the City, and the Work shall be completed as provided in the revised schedule.
- (e) Where the Work or any part thereof is suspended on the written instructions of the City and if permission to resume Work is not given by the City within a period of thirty days from the date of suspension, the Contractor may request permission from the City to proceed with the Work. If the City does not grant permission within fourteen days' receipt of the Contractor's written request, the Contractor may elect to treat the suspension, where it affects only part of the Work, as an omission of such Work by giving a further notice to the City to that effect or, where it affects the whole of the Work, treat this Contract as having been cancelled by the City, in accordance with GC 10.4.

10.3 Termination by City

- (a) Without limitation, any or all of the following actions by or circumstances relating to the Contractor shall constitute default on the part of the Contractor:
 - (i) Committing or threatening to commit any act of insolvency or bankruptcy, voluntary or otherwise;
 - (ii) Having a receiver appointed on account of insolvency or in respect of any property;
 - (iii) Making a general assignment for the benefit of creditors;
 - (iv) Failing to comply with or persistently disregarding statutes, regulations, bylaws or directives of competent authorities relating to the Work;
 - (v) Failing to comply with any requests, instruction or direction of the Engineer;
 - (vi) Failing to pay accounts relating to the Work as they come due;
 - (vii) Failing to prosecute the Work with skill and diligence;
 - (viii) Assigning or subletting this Contract or any portion thereof without the required consent from the City;
 - (ix) Failing or refusing to correct defective or deficient Work; and
 - (x) Being otherwise in default in carrying out any of its obligations under this Contract, whether such default is similar or dissimilar in nature to the causes listed previously.

- (b) The Contractor shall immediately advise the City in writing of any default listed in GC 10.3(a)
- (c) If the Contractor is in default under this Contract, the City shall be entitled to any or all of the following:
 - (i) Take possession of all Work in progress, materials and construction equipment at the Site, at no additional charge for the retention or use of the construction equipment;
 - (ii) Eject and exclude from the Site all personnel of the Contractor and any Subcontractor;
 - (iii) Terminate the City's utilization of the Contractor to perform the Work;
 - (iv) Finish the Work by whatever means the City may deem appropriate under the circumstances; and
 - (v) Withhold any further payments to the Contractor until the Contractor's liability to the City is ascertained.
- (d) The Contractor shall be liable to the City for:
 - (i) The extra expense of finishing the Work, including compensation to the City for additional engineering, managerial and administrative services;
 - (ii) The cost of correcting deficiencies in that portion of the Work performed by the Contractor; and
 - (iii) All other loss, damage and expense occasioned to the City by reason of the Contractor's default,

and the City may deduct such amounts from payments owing to the Contractor under this Contract.
- (e) Any action by the City under this GC 10.3 shall be without prejudice to the City's other rights or remedies under any security held by the City for performance of this Contract by the Contractor.

10.4 Contract Cancellation

- (a) The City shall have the right which may be exercised from time to time, with or without cause, and on fourteen days' written notice to the Contractor, to cancel any uncompleted or unperformed portion of the Work. In the event of such cancellation, the Contractor shall be entitled to the following:
 - (i) Reimbursement at this Contract rate for all items completed and delivered;
 - (ii) Reimbursement for the costs to the Contractor for Work in progress and expenses incurred in the course of the Work, plus a reasonable return on such costs and expenses; and

- (iii) Reimbursement for costs and expenses directly caused by the cancellation.
- (b) Title to all Work for which reimbursement is made shall vest in the City.
- (c) The City shall not be liable to the Contractor for indirect loss, consequential loss, loss of business opportunity or loss of anticipated profit on the cancelled portion or portions of the Work.
- (d) This section shall not apply to situations in which the City is entitled to terminate this Contract by reason of default by the Contractor.

10.5 Termination by Contractor

- (a) If the City should be adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the City's insolvency, or if a receiver is appointed because of the City's insolvency, the Contractor may, without prejudice to any other right or remedy the Contractor may have, by giving the City or receiver or trustee in bankruptcy notice in writing, terminate this Contract.
- (b) If the Work should be stopped or otherwise delayed for a period of thirty days or more under an order of a court or other public authority and providing that such order was not issued as the result of an act or fault of the Contractor or of anyone directly or indirectly employed or engaged by the Contractor, the Contractor may, without prejudice to any other right or remedy the Contractor may have, by giving the City notice in writing, terminate this Contract.
- (c) If the Contractor terminates this Contract under the conditions set out above, the Contractor shall be entitled to be paid for all work performed including reasonable profit, for loss sustained upon products and construction machinery and equipment, and such other damages as the Contractor may have sustained as a result of the termination of this Contract.

11. BONDS AND WARRANTY

11.1 Obligations to Provide Contract Security

- (a) The Contractor shall promptly provide to the City the surety bonds called for in the Contract Documents, not later than ten days following receipt by the Contractor of the letter of acceptance.
- (b) Such bonds shall be issued by a duly licensed surety company authorized to transact the business of suretyship in Nunavut and shall be maintained in good standing until the fulfillment of this Contract.
- (c) Prior to or at the time of making a Claim under such bonds, the City shall send written notification to the Contractor, stating the nature of the default for which a Claim is being made.

11.2 Prescription of Acceptable Contract Security

- (a) The Contractor shall deliver to the City:

- (i) A performance bond and a labour and material payment bond each in an amount that is equal to and not less than fifty percent of the Contract Price referred to in the Articles of Agreement; or
 - (ii) A security deposit in an amount that is equal to ten percent of the Contract Price referred to in the Articles of Agreement.
- (b) The performance bond and the labour and material payment bond referred to in GC 11.2(a)(i) shall be in a form as approved by the Federal Treasury Board (Federal Contracts).
- (c) A security deposit referred to in GC 11.2(a)(ii) shall be in a form of:
 - (i) An irrevocable letter of credit in a form acceptable to the City and from a bank and branch acceptable to the City; or
 - (ii) A certified cheque or bank draft from a bank acceptable to the City and made payable to the City.
- (d) Should the Contractor's irrevocable letter of credit be scheduled to expire prior to the Completion Date set out in the Articles of Agreement, the City may, at any time within the fourteen days prior to the expiry date, call upon and draw down the irrevocable letter of credit, unless the Contractor presents a renewal thereof with an expiry date beyond the anticipated date for Final Completion, as determined by the Engineer.

11.3 Return of Security Deposit

- (a) Following issuance of the certificate of Substantial Completion, the City may, in its absolute discretion, release all or part of the security deposit referred to herein.
- (b) Following issuance of the certificate of Final Completion, the Contractor shall, subject to the terms of this Contract, be entitled to the remainder of any security deposit.
- (c) Interest shall not be paid on security deposits.

11.4 Warranty

- (a) The Contractor warrants and guarantees that the Work is and shall be free from all defects or deficiencies in, or arising from, materials or workmanship in any part of the Work for the period of one year from the date of Substantial Completion of the Work, as certified by the Engineer, or such longer period as may be specified in the Contract Documents for certain products or Work.
- (b) The Contractor shall promptly correct, at its own expense, defects or deficiencies in the Work which appear prior to and during the warranty described in GC 11.4(a). The Contractor shall correct and pay for all damages resulting from corrections made under this provision.
- (c) Work performed to correct defects or deficiencies shall be warranted and guaranteed to be free from defects or deficiencies, on the same basis as the original Work, for a period of one year from the day said work was completed.

- (d) The City or the Engineer shall promptly give the Contractor written notice of observed defects and deficiencies.
- (e) If any defects or deficiencies in the Work appear at any time prior to the end of the warranty period, the Engineer may instruct the Contractor to search for the cause thereof. If such defect or deficiency is one for which the Contractor is liable, the cost of the Work carried out in searching shall be at the Contractor's expense, and it shall in such case remedy such defect or deficiency at its own cost; otherwise it shall be at the City's expense.
- (f) In an emergency or to prevent an emergency or if the Contractor neglects for any reason to correct defects or deficiencies within a reasonable time, the City may perform the Work or direct another party, on the City's behalf, to do the Work. All costs associated with the correction of such defects or deficiencies shall be paid for by the Contractor and the City may deduct such costs from amounts owing to the Contractor.

12. INDEMNIFICATION AND INSURANCE

12.1 Indemnification by Contractor

- (a) The Contractor shall defend, indemnify and save harmless the City and the Engineer, their agents and employees from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of or attributable to the Contractor's performance of the Work, or by reason of any matter or thing done, permitted or omitted to be done, by the Contractor, its Subcontractors, or their agents or employees, whether occasioned by negligence or otherwise. Such indemnity shall survive completion or termination of this Contract.
- (b) Nothing contained in the Contract Documents or any approval, express or implied, of the Engineer or City shall relieve the Contractor of any liability for latent defects or any liability which may be imposed by law.

12.2 Indemnification by City

The City shall, subject to any law that affects the City's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damages, actions, suits or proceedings arising out of his activities under this Contract that are directly attributable to:

- (a) Lack of or a defect in the City's title to the Site whether real or alleged; or
- (b) An infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of this Contract employing a model, plan or design or any thing related to the Work that was supplied by the City to the Contractor.

12.3 Policies of Insurance

Without restricting the generality of GC 12.1, the Contractor shall provide, maintain and the insurance coverages listed in this provision. Unless otherwise stipulated, the duration

of each insurance policy shall be from the date of commencement of the Work until the date of issuance of the certificate of Final Completion. Prior to commencement of the Work, the Contractor shall provide the City with confirmation of coverage in the format attached as Appendix A to these General Conditions, and, if required, a certified true copy of the policies certified by an authorized representative of the Insurer. The Contractor shall ensure that any Subcontractors comply with the insurance requirements outlined in this GC 12. The insurance coverages required are as follows:

(a) **General Liability Insurance**

Contractor's comprehensive general or commercial general liability insurance shall have limits of not less than five million dollars per occurrence with a property damage deductible not exceeding two thousand five hundred dollars. The insurance provided shall be no less broad than the insurance provided by IBC Form 2100 or its equivalent replacement and shall include a standard non-owned automobile policy including a blanket contractual liability endorsement. To achieve the required limit, umbrella or excess liability insurance may be used. All liability coverage shall be maintained for completed operations hazards from the date of Final Completion of the Work, as set out in the certificate of Final Completion, on an ongoing basis for a period of not less than six years from the date of such certificate. The City shall be added as an additional insured with respect to liability arising out of the operations of the named insured. The policy shall be endorsed to provide the City with not less than thirty days' written notice in advance of any cancellation, change or amendment restricting coverage.

(b) **Automobile Liability Insurance**

Automobile liability insurance in respect of licensed vehicles shall have limits of not less than five million dollars inclusive per occurrence for bodily injury, death, and damage to property and covering all licensed vehicles owned or leased by the Contractor, endorsed to provide the City with not less than fifteen days' written notice in advance of any cancellation, change or amendment restricting coverage.

(c) **Property and Boiler and Machinery Insurance**

- (i) "All risks" property insurance shall be in the joint names of the Contractor, the City and the Engineer, insuring not less than the sum of the amount of the Contract Price and the full value of all labour, plant, equipment and materials that are to be provided by the City for incorporation into the Work, with a deductible not exceeding two thousand five hundred dollars. The insurance provided shall be no less broad than the insurance provided by IBC Form 4042 or its equivalent replacement. The policy will contain a waiver of rights of subrogation against all those insured by the policy. Such coverage shall be maintained continuously until the date the certificate of Final Completion is issued or an earlier date specified by the City;
- (ii) The policy will allow for partial or total use or occupancy of the Work. If because of such use or occupancy the Contractor is unable to provide coverage, the Contractor shall notify the City in writing prior to such use pay for property and, if necessary, boiler insurance insuring the full value of the Work as in (i) above, including coverage for such use or occupancy and shall provide the Contractor with proof of such insurance. The

Contractor shall refund to the City the unearned premium applicable to the Contractor's policy upon termination of coverage;

- (iii) Where, due to the nature of the Work, the full insurable value of the Work is substantially less than the Contract Price, the City may, at its sole discretion, reduce the amount of insurance required or waive the course of construction insurance requirement;
- (iv) Where such risks exist, the Contractor shall provide boiler and machinery insurance insuring not less than the replacement value of boilers, pressure vessels and other objects insurable under a boiler & machinery policy and forming part of the Work;
- (v) The policies shall provide that, in the event of a loss or damage, payment shall be made to the City and the Contractor as their respective interests may appear. The Contractor shall act on behalf of the City for the purpose of claiming the amount of loss or damage from the Insurers. When the extent of the loss or damage is determined, the Contractor shall proceed to restore the Work. Loss or damage shall not affect the rights and obligations of either party under this Contract except that the Contractor shall be entitled to such reasonable extension of Contract Time relative to the extent of the loss or damage in accordance with the terms of this Contract; and
- (vi) The Contractor shall be responsible for deductible amounts under the policies except where such amounts may be excluded from the Contractor's responsibility in accordance with the Contract documents.

(d) **Aircraft and Watercraft Liability Insurance**

Where such risks exist, the Contractor shall obtain aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft if used directly or indirectly in the performance of the Work, including use of additional premises, and shall have limits of not less than two million dollars inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof, and limits of not less than two million dollars for aircraft passenger hazard. Such insurance shall be in a form acceptable to the City. The policies shall be endorsed to provide the City with not less than fifteen days' written notice in advance of any cancellation, change or amendment restricting coverage.

(e) **Contractor's Equipment insurance**

The Contractor shall give proof of insurance in a form acceptable to the City of "all risks" Contractor's equipment insurance covering construction machinery and equipment used by the Contractor for the performance of the Work, including boiler insurance on temporary boilers and pressure vessels. The insurance shall be in a form acceptable to the City and shall not allow subrogation claims by the insurer against the City. The policies shall be endorsed to provide the City with not less than fifteen days' written notice in advance of cancellation, change or amendment restricting coverage.

(f) **Other Insurance**

The Contractor shall provide, maintain and pay for any additional insurance required to be provided by law, or which the Contractor considers necessary to cover risks not otherwise covered by insurance specified in the Contract Documents.

12.4 Insurance General

- (a) All required insurance policies shall be with insurers licensed to underwrite insurance in Nunavut and signed by representatives licensed to do so for insurance in Nunavut.
- (b) The Contractor shall require and ensure that its Subcontractors maintain liability insurance comparable to that required above.
- (c) If the Contractor fails to provide or maintain insurance as required by this General Condition or elsewhere in the Contract Documents, then the City shall have the right to provide and maintain such insurance and give evidence to the Contractor and the Engineer. The Contractor shall pay the cost thereof to the City on demand or the City may deduct the costs from monies which are due or may become due to the Contractor.
- (d) Where an insurer fails or refuses to pay any claims under an insurance policy covering the activities of the Contractor or a Subcontractor relating to or arising out of the Work, the Contractor shall not be released from any liability arising under this Contract.

13. LOCAL AND INUIT INVOLVEMENT

13.1 Requirements for Inuit, Local and Nunavut Content

- (a) The Contractor shall, in the performance of the Work, employ Inuit, Local and Nunavut workers and use Inuit, Local and Nunavut content to the greatest extent possible and at a minimum, no less than the amounts tendered by the Contractor in Appendix J-2 "Substantiation of Bid Adjustment" of the tender. Workers shall meet all levels of proficiency, qualification and expertise as dictated by Applicable Laws and/or as defined in the Contract Documents.
- (b) The Contractor shall provide to the Engineer a schedule indicating the anticipated total monthly value of all Inuit, Local and Nunavut content and labour to be expended in the execution of the Work. This schedule shall provide the benchmark for ensuring compliance by the Contractor with the requirements for the use of Inuit, Local and Nunavut content during the performance of the Work.
- (c) For the Inuit Labour bonus or penalty, as set out in the Nunavummi Nangminiqagtunik Ikajuuti (NNI) Policy, the benchmark shall be the minimum prescribed level for Inuit Labour identified on page 4 of Appendix K "Contractor's Obligations to Provide Inuit Content" of the tender.

13.2 Requirement for Community Meetings

- (a) The Contractor shall arrange meetings on a monthly basis, or other basis as may be mutually agreed by the parties to this contract, to monitor the use of Inuit, Local and Nunavut labour and Inuit, Local and Nunavut content. The Contractor shall give the City 5 days notice of all meetings called under GC 13.2. The Contractor shall take reasonable steps to ensure that these meetings include the following representatives:
 - (i) A community representative who has been designated to speak on behalf of the community (if available);
 - (ii) A community manpower representative (if available);
 - (iii) The Contractor; and
 - (iv) The Engineer.
- (b) In addition to the community meetings contemplated in GC 13.2(a), the Contractor shall arrange a community meeting prior to the start of the Work which shall be arranged on the same terms as indicated in GC 13.2(a) and at that meeting shall:
 - (i) Provide a schedule referred to in GC 13.1(b) above to the community representative;
 - (ii) Request from the community manpower representative or from the City if no community manpower representative has been delegated, a list of workers available in the community; and
 - (iii) Identify specific types of workers required during the project such as plumbers, painters or electricians and how many of those workers are required and when they are required and based on information received in accordance with GC 13.2(b)(ii) maintain a list of community manpower.
- (c) At the community meetings contemplated in GC 13.2(a), the Contractor shall:
 - (i) Provide employment reports identifying workers used during the past month (to substantiate information provided on Appendix J-2 "Substantiation of Bid Adjustment");
 - (ii) Provide an schedule referred to in GC 13.2(b)(i), or such schedule as amended, if necessary; and
 - (iii) Provide a consolidated report at the time of Substantial Completion, which shall confirm the total amount of Inuit, Local and Nunavut content used. This report will identify Inuit, Local and Nunavut payroll separately. This consolidated report shall be a condition precedent to the release of payment.
- (d) The City shall attend all community meetings organized by the Contractor in accordance with this GC 13.2 and when requested by the Contractor shall identify and contact potential community workers who may be available to be employed on the Work, identify alternate workers if those workers initially

identified are not available to work, and assist in confirming the residency of local workers.

13.3 Monitoring the Level of Inuit, Local and Nunavut Labour

- (a) The Contractor is responsible to ensure that every worker identified as Local or Nunavut meets the qualifying requirements, which are, for Nunavut, being ordinarily resident in Nunavut for the past 12 months, and for Local being a Nunavut resident ordinarily resident in the subject community for the past 4 months. The Contractor may be required to provide proof of residency of workers at any time throughout the course of performing the Work.
- (b) Reasonable proof of Nunavut and Local residency shall be any of the following:
 - (i) Being listed on the Nunavut Tunggavik Inc. (NTI) enrolment list and provision of a physical address where residing;
 - (ii) If the last 12 months have been spent as ordinarily resident in Nunavut and a physical address of such residence has been provided, then
 - (A) Provides a valid Nunavut Health Care Card effective at least 9 months prior to start date of employment on the Work; and/or
 - (B) Provides another accepted proof of residency such as: a Nunavut General Hunting License, a Nunavut Driver's Licence, a lease or rental receipt, or a certified Schedule T222 Income Tax return from the previous year or proof that Income Tax was paid in the Nunavut during the previous tax year; or
 - (iii) Is included on a list of approved Local or Nunavut residents verified by the municipality of their residence.
- (c) The Contractor is responsible to ensure that every worker identified as Inuit is on the NTI Inuit enrolment list, or would qualify to be on the list.
- (d) If requested by the City to do so, the Contractor shall obtain a signed consent form from workers which verifies their residency and permits the City to obtain any and all information required to support the worker's claim of residency and/or Inuit status. A worker does not need to comply with the requirements of this clause if the worker is on the NTI Inuit enrolment list.

13.4 Failure to Comply with Proposed Inuit, Local and Nunavut Content

- (a) The City and the Contractor recognize the high cost of living in Nunavut, and the need to build capacity of Inuit firms and labour in Nunavut, which is compensated for by the City through the provision of bid adjustments for the use of Inuit, Local and Nunavut labour and other Inuit, Local and Nunavut content, and the provision of bonuses under the Nunavummi Nangminiqagtunik Ikajuuti (NNI) Policy. It is a priority of the City to maximize the opportunities for Inuit, Local and Nunavut workers and businesses to benefit from government contracts and the City may pay a premium in awarding its contracts to support this important objective.

- (b) Therefore, it is a fundamental requirement of this Contract that the Contractor shall achieve, by the completion of this contract, at least the amounts tendered on Appendix J-2 "Substantiation of Bid Adjustment" of the tender, with the exception of decreasing Nunavut content with a corresponding equal or larger increase in Local content, specifically:

(i) The amount of Inuit labour;

AND

- (ii) (A) The amount of Local labour and the amount of Nunavut labour; or
(B) The amount of Local labour and the total amount of Local and Nunavut labour

Which the Contractor has identified in Appendix J-2 "Substantiation of Bid Adjustment" of the Tender,

AND at least:

- (iii) The amount of Inuit content excluding the labour of Inuit firms; and
(iv) (A) The amount of Local content (excluding Local labour) and the amount of Nunavut content (excluding Nunavut labour); or
(B) The amount of Local content (excluding Local labour) and the total amount of Local and Nunavut content (excluding Local and Nunavut labour)

Which the Contractor has identified in Appendix J-2 "Substantiation of Bid Adjustment".

- (c) In the event that the amounts of Inuit, Local and Nunavut expenditures actually achieved by the Contractor are less than the amounts identified in clauses GC13.4(b) then the City may adopt one or more of the following remedies:

- (i) Withhold from any progress payment an amount equal to:
(A) The difference between the amounts identified in GC13.4(b) (i), (ii)(A), or (ii)(B) and the amount identified in the schedule referred to in GC13.1(b); and
(B) The difference between the amounts identified in GC13.4(b) (iii), (iv)(A), or (iv)(B) and the amount identified the schedule referred to in GC13.1(b).

Which amount may be released to the Contractor if at the date of a subsequent request the difference has been eliminated; or

- (ii) Deduct from the approved contract payment at the time of Substantial or Final completion an amount equal to:

- (A) 25% of the difference between the amounts identified in GC13.4(b) (i), (ii)(A), or (ii)(B) and the amount identified in Appendix J-2 "Substantiation of Bid Adjustment"; and
- (B) 25% of the difference between the amounts identified in GC13.4(b) (iii), (iv)(A), or (iv)(B) and the amount identified in Appendix J-2 "Substantiation of Bid Adjustment"; or
- (iii) Terminate this Contract, in accordance with GC10.3.
- (d) In the event that the amount of difference identified in GC13.4(c) is 15% or less of the amount proposed in Appendix J-2 "Substantiation of Bid Adjustment" of the tender, the City, at its sole discretion, may waive the provisions of clause 13.4(c).

13.5 Requirement for Using Hotels or Bed and Breakfast

- (a) If performance of the Work is undertaken where a Commercial Room and Board Facility (as defined below) exists within a Community (as defined below), the Tenderer is required to use a Commercial Room and Board Facility to house and feed all workers directly employed by the Contractor, any Subcontractor or agent or any other business working on the Project. The Contractor, Subcontractor, agent or other business are not required to use Commercial Room and Board Facilities for workers who are Local Residents as defined in the NNI Policy.
- (b) In this Contract:
 - (i) "Commercial Room and Board Facility" means a Hotel or a Bed and Breakfast (Tourist Home) that holds a Tourist Establishment Licence issued by the Government of Nunavut under the *Travel and Tourism Act*.
 - (ii) "Community" means a community in which the Work (as defined in the Contract) is being performed and includes the entire area within a 20-kilometre radius of that community.
- (c) The Commercial Room and Board Facility must:
 - (i) Meet the applicable requirements under the *Public Health Act*, and of the *Eating or Drinking Place Regulations*; and
 - (ii) Meet all applicable requirements of the *Public Health Act* the *Fire Prevention Act* and applicable regulations thereunder, and any other applicable Government of Nunavut or federal legislation.

14. TRANSPORTATION OF MATERIALS

14.1 Marine Transport

- (a) Whenever marine (water) transport is to be utilized, the Contractor shall use, and space should be booked directly with the following carrier:
 - (i) Nunavut Sealink and Supply (NSSI),
By ships loading at the Montreal area Port of Ste-Catherine
Contact: Daniel Desgagnés
Phone: (450) 635-0833
Fax: (450) 635-5126
- (b) The annual shipping rates offered by marine carriers are dependent upon anticipated cargo quantities including the materials for construction projects; therefore, Contractors are to tender using the published sailing schedules and rates available from the above marine carriers, and also available from the Department of Public Works and Services, Finance Division, Contact: John Fast, Traffic Coordinator at (867) 975-5437.
- (c) In exceptional or extraordinary circumstances, where the specified marine carrier's sailing schedule is in substantial conflict with the Construction Schedule, the City will review the circumstances, taking into account the adverse impact on the project and the specified marine carrier's interests, and the City may provide authorization to allow the relevant cargo to be shipped with a marine carrier other than the specified marine carrier, depending upon the circumstances; and such authorization must be writing.
- (d) If a Contractor uses a marine carrier other than the City contracted marine carrier without the City's written authorization to do so, the Contractor shall be responsible for extra freight cost, administrative costs or any other costs, incurred by the City which result directly or indirectly from the Contractor's failure to use the City specified marine carrier as set out in this GC 14. The Contractor shall also be responsible to refund to the City any monies saved by the Contractor by using a marine carrier other than the specified marine carrier as set out in this GC 14.

END OF GENERAL CONDITIONS

APPENDIX "A" TO GENERAL CONDITIONS

CONTRACTOR'S CERTIFICATE OF INSURANCE

INSURED:

PROJECT NAME: City of Iqaluit Wastewater Treatment Plant Upgrade

SCHEDULE OF MANDATORY INSURANCE

Type of Insurance	Insurer, Policy Number	Policy Period	Limit of Liability/Amount
Comprehensive General Liability including Non-Owned Automobile Liability		From _____ To: _____	Bodily Injury \$ _____ Each Person \$ _____ Each Accident \$ _____ Aggregate Products Property Damage \$ _____ Each Accident \$ _____ Aggregate Products OR Bodily Injury & Property Damage \$ _____ Inclusive \$ _____ Aggregate Products
Automobile Liability (Owned/Leased Vehicles)		From: _____ To: _____	Bodily Injury \$ _____ Each Person \$ _____ Each Accident Property Damage \$ _____ Each Accident OR Bodily Injury & Property Damage \$ _____ Inclusive
Property and Boiler and Machinery Insurance		From _____ To: _____	\$ _____
Contractor's Equipment		From _____ To: _____	\$ _____
OTHER			

This is to certify that policies of insurance as described above, and in the General Conditions of this Contract for Construction, have been issued through the undersigned to the Insured named above and are in force at this time. If cancelled or changed in any manner for any reason, during the period of coverage as stated herein so as to affect this certificate, immediate written notice will be given by the undersigned to the Manager, Public Works & Engineering, City of Iqaluit, Nunavut, PO Box 460, Iqaluit, Nunavut, X0A 0H0.

Name and Address of Insurance Agent, Broker or Insurance Company:

Date: _____

By: _____
(Authorized Representative)

**THE CITY OF IQALUIT
SUPPLEMENTARY GENERAL
CONDITIONS FOR
IQALUIT WASTEWATER TREATMENT PLANT UPGRADE
FINE SCREEENS SUPPLY
PROJECT NO. IQA15-4964-C**

The following clauses of the General Conditions are to be modified.

- i. **1 . General Provisions 1.1 Definitions, replace (z):**
Supplier or Supply Contractor: within these contact documents defined as Contractor having a direct contract with the Owner or Novated to General Contractor to supply products to the Work.
- ii. **3.7 Superintendent:** Delete.
- iii. **3.10 Use of the Site:** Delete.
- iv. **3.11 Survey:** Delete.
- v. **3.12 Protection of the Work, Property and the Public:** Delete.
- vi. **3.19 Cutting and Patching:** Delete.
- vii. **13. Local and Inuit Involvement:** Delete.

City of Iqaluit
Request for Quotation
WASTEWATER TREATMENT PLANT UPGRADE
Fine Screens Supply

Addendum No. 01
February 14, 2018

This Addendum forms part of the Tender Documents and modifies them as stated herein. Addendum issued to active tenderers with documents on record (2 pages not including attachments).

A. CONTRACT SPECIFICATIONS

00 21 00 – Instructions to Bidders

1. **4.1** Add copied to Eslam.Maher@colliersprojectleaders.com.

40 05 00 – General Provisions Process

1. **2.7 Clarification:** The City's Engineer is designing a steel frame platform to support the units. Typically for a steel to steel connection, grade A325 bolts would be used, but the Supplier can specify a different grade if required. The manufacturer of the unit will indicate where the anchor points are so that the design can allow for them in the framing configuration. The Supplier will also indicate the loads at the connection points to incorporate into the design of the frame.

46 21 33 – Fine Screen

1. **1.3.2 Clarification:** The fine screen unit as a whole does not require CSA approval, all equipment and components contained and associated with the unit that are governed by CSA, must have CSA approval.

2. **1.4.2.11 Clarification:**

The plant PCS requires hard-wired connections for the following signals, at minimum:

- Run Status, dry contact 24V rated
- General Alarm Status, dry contact, 24V rated
- Emergency stop active, dry contact, 24V rated
- Auto Status, dry contact, 24V rated

- Level signal from Ultrasonic, isolated 4-20mA signal
- Permissive signal from PCS, we will provide a dry contact 250V, 2A rated – Close on OK to run, open on not OK to run

The PCS network is Ethernet/IP based (Allen Bradley ControlLogix). Provide a Cat6 cable, if providing a compatible PLC. Any communication with this system will be for monitoring only.

3. **2.1.4 Clarification:** The Supplier shall minimize the amount of field assembly required, ship in a manner that minimizes field assembly, and indicate in this submission, the general field assembly required by the Contractor with details provided during the shop drawing submission stage.
4. **2.4.11.1.1 Clarification:** Replace with:
Basket Zone: spiral OD 515 mm, inner flight 25 mm, outer flight 6 mm, flight height 208 mm
5. **2.4.11.1.2 Clarification:** Replace with:
Transport Zone: spiral OD 250 mm, inner flight 25 mm, flight height 75 mm
6. **2.7.3.1 Clarification:** Either of these will be acceptable:
 - The switches can be rated for Zone 2 applications and mounted in a NEMA 4X enclosure, or
 - The switches can be general purpose rated but they must be mounted in mounted in a NEMA 7X enclosure.
7. **3.1.3 Clarification:** It is anticipated that Item 7 (Commissioning) will be combined in one singular trip with Items 5 and 6. Noting that the General Contractor may require site trips, which will be at their cost.

END OF ADDENDUM NO. 01

DIVISION 01 – GENERAL REQUIREMENTS

Part 1 General

1.1 SECTION INCLUDES

- .1 Applications for payments.
- .2 Substantial performance procedures.
- .3 Release of holdback procedures.
- .4 Schedule of values.

1.2 RELATED SECTIONS

- .1 Section 00 54 00 – Terms of Payment

1.3 REFERENCES

- .1 Owner/Contractor Agreement.

1.4 APPLICATIONS FOR PROGRESS PAYMENT

- .1 Make applications for payment on account as provided in City of Iqaluit Terms of Payment as Work progresses.
- .2 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
- .3 Submit to Engineer at least 14 days before first application for payment, a Schedule of Values for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment.

1.5 ACCEPTANCE PROCEDURES

- .1 Make schedule of values out in such form and supported by such evidence as Engineer may reasonably direct and when accepted by Engineer, be used as basis for applications for payment.
- .2 Include statement based on schedule of values with each application for payment.
- .3 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Engineer may reasonably require to establish value and delivery of products.

1.6 PROGRESS PAYMENT

- .1 In accordance with Government of Nunavut Terms of Payment Engineer will issue to Owner, no later than 10 working days after receipt of an

application for payment, certificate for payment in amount applied for or in such other amount as Engineer determines to be properly due. If Engineer amends application, Engineer will give notification in writing giving reasons for amendment.

1.7 SUBSTANTIAL PERFORMANCE OF WORK

- .1 Prepare and submit to Engineer comprehensive list of items to be completed or corrected and apply for a review by Engineer to establish Substantial Performance. Failure to include an item on list does not alter responsibility to complete Contract.
- .2 No later than 21 days after receipt of list and application, Engineer will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.
- .3 Engineer shall state date of Substantial Performance of Work or designated portion of Work in certificate.
- .4 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Engineer, establish reasonable date for finishing Work.

1.8 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

- .1 After receipt of application for payment and sworn statement, Engineer will issue certificate for payment of holdback amount.
- .2 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount any sums required by law to satisfy any liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.9 FINAL PAYMENT

- .1 Submit an application for final payment when Work is completed.
- .2 Engineer will, no later than 21 days after receipt of an application for final payment, review Work to verify validity of application. Engineer will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.

- .3 Engineer will issue final certificate for payment when application for final payment is found valid.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout Submittals.

1.2 ADMINISTRATIVE

- .1 Submit to the Engineer submittals listed for review and submit via email in digital Adobe Acrobat (.pdf) format. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.
- .10 Keep one reviewed copy of each submission on site.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Where necessary, submit drawings stamped and signed by professional engineer registered or licensed in Nunavut.

- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 10 days for Engineer's review of each submission.
- .5 Adjustments made on shop drawings by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
- .6 Make changes in shop drawings as Engineer may require, consistent with Contract Documents. When resubmitting, notify Engineer in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Shop drawings must be submitted with the appropriate Specification Sections attached noting both compliance with and deviations from the Specifications.
- .9 Submissions must include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Selected material must be clearly identified. Cutsheets with no material selection will be returned.
 - .5 Site specific equipment tag numbers.
 - .6 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

Submissions without Contractor's stamp shall be returned without Engineer's review.

- .7 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .10 After Engineer's review, distribute copies.
- .11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Engineer may reasonably request.
- .12 Submit digital copy of test reports for requirements requested in specification Sections and as requested by Engineer.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accordance with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit digital copy of certificates for requirements requested in specification Sections and as requested by Engineer.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit digital copy of manufacturers instructions for requirements requested in specification Sections and as requested by Engineer.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

- .15 Submit digital copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Engineer.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit digital copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Engineer.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Engineer, no errors or omissions are discovered or if only minor corrections are made, shop drawing will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.4 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Engineer.
- .3 Notify Engineer in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
- .6 Make changes in samples which Engineer may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 PROGRESS PHOTOGRAPHS

- .1 Submit progress photographs in electronic format and taken bi-weekly and show advancement of the prior weeks work. All photos to be date stamped and be named for the specific work shown in the photograph.

1.6 OPERATION AND MAINTENANCE MANUALS

- .1 Prior to Substantial Performance of the Work, Subcontractor shall deliver to the Contractor copies of a manual presenting the operation and

maintenance of the building and its equipment as specified in the Contract Documents and in accordance with Section 01 78 00 - Closeout Procedures.

1.7 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcript of insurance immediately after award of contract.

1.8 RECORD DOCUMENTS

- .1 Subcontractor shall submit Record Documents at Substantial Performance of the Work in accordance with the Contract Documents and Section 01 78 00 - Closeout Submittals. Failure to submit Record Documents will result in a holdback of 5% of the Contract Price.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ASSOCIATIONS

- .1 AA - Aluminum Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006 URL <http://www.aluminum.org>
- .2 AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL <http://www.aashto.org>
- .3 ACEC Association of Consulting Engineers of Canada, 130 Albert Street, Suite 616, Ottawa, ON. K1P 5G4 URL <http://www.acec.ca>
- .4 AHA - American Hardboard Association, 1210W Northwest Hwy., Palatine, Illinois, U.S.A. 60067 URL: <http://www.hardboard.org>
- .5 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, Colorado, U.S.A. 80112 URL <http://www.aitc-glulam.org>
- .6 AMCA - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, Illinois, U.S.A. 60004-1893 URL <http://www.amca.org>
- .7 ANSI - American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, New York, U.S.A. 10036 URL <http://www.ansi.org>
- .8 APA - The Engineered Wood Association, P.O. Box 11700, Tacoma, Washington, U.S.A. 98411-0700 URL <http://www.apawood.org>
- .9 API - American Petroleum Institute, 1220 L St. Northwest, Washington, D.C., U.S.A. 20005-4070 URL <http://www.api.org>
- .10 ARI - Air Conditioning and Refrigeration Institute, 4100 N Fairfax Drive, Suite 200, Arlington, Virginia, U.S.A. 22203 URL <http://www.ari.org>
- .11 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL <http://www.ashrae.org>
- .12 ASME - American Society of Mechanical Engineers, ASME Headquarters, 3 Park Avenue, New York, New York, U.S.A. 10016-5990 URL <http://www.asme.org>
- .13 ISAP - International Society for Asphalt Paving, 400 Selby Avenue, Suite 1, St. Paul, MN 55102 U.S.A. URL <http://www.asphalt.org>
- .14 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 URL <http://www.astm.org>

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- .15 AWCI - Association of the Wall and Ceiling Industries International, 803 West Broad Street, Suite 600, Falls Church, VA, U.S.A. 22046 URL <http://www.awci.org>
 - .16 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516-4 Street West, High River, Alberta T1V 1B6 URL <http://www.awmac.com>
 - .17 AWWA - American Wire Producer's Association, 801 N Fairfax Street, Suite 211, Alexandria, VA U.S.A. 22314-1757 URL <http://www.awpa.org>
 - .18 AWWA - American Wood Preservers' Association, P.O. Box 5690, Granbury Texas, U.S.A. 76049-0690 URL <http://www.awpa.com>
 - .19 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 URL <http://www.amweld.org>
 - .20 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 URL <http://www.awwa.org>
 - .21 CCA Canadian Construction Association, 75 Albert St., Suite 400 Ottawa, Ontario, K1P 5E7 URL <http://www.cca-acc.com>
 - .22 CCDC Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC
 - .23 CFFM - Canadian Forces Fire Marshal, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2 URL <http://www.dnd.ca/admie/dgcps/CFFMe.htm>
 - .24 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL <http://www.cga.ca>
 - .25 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 0S5 URL <http://w3.pwgsc.gc.ca/cgsb>
 - .26 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8 URL <http://www.cisc-icca.ca>
 - .27 CLA - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, Ontario, K1N 8C7 URL <http://www.cla-ca.ca>
 - .28 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL <http://www.canadanursery.com>
 - .29 CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 1300, Ottawa, Ontario K1P 6L1 URL <http://www.roofingcanada.com>
 - .30 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL <http://www.csa-international.org>

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- .31 CSC - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, Ontario M5A 4K2 URL <http://www.csc-dcc.ca>
 - .32 CSDMA - Canadian Steel Door Manufacturers Association, One Yonge Street, Suite 1801, Toronto, Ontario M5E 1W7
 - .33 CSPI - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cspi.ca>
 - .34 CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cssbi.ca>
 - .35 CUFCA Canadian Urethane Foam Contractor's Association, Box 3214, Winnipeg, Manitoba, R3C 4E7 URL <http://www.cufca.ca>
 - .36 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 URL <http://www.cwc.ca>
 - .37 EC - Environment Canada, Conservation and Protection, Inquiry Centre, 351 St. Joseph Blvd, Hull, Quebec K1A 0H3 URL <http://www.ec.gc.ca>
 - .38 EFC - Electro Federation of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL <http://www.electrofed.com>
 - .39 EIMA EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, Georgia U.S.A. 30260 URL <http://www.eima.com>
 - .40 FCC - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull, Quebec K1A 0J2 <http://info.load-otea.hrdc-drhc.gc.ca/fire-prevention/standards/commissioner.shtml>
 - .41 IEEE - Institute of Electrical and Electronics Engineers, IEE Corporate Office, 3 Park Avenue, 17th Floor, New York, New York U.S.A. 10016-5997 URL <http://www.ieee.org>
 - .42 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL <http://www.paintinfo.com>
 - .43 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A. 22180-4602 URL <http://www.mss-hq.com>
 - .44 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 URL <http://www.naamm.org>
 - .45 NABA - National Air Barrier Association, PO Box 2747, Winnipeg, Manitoba R3C 4E7 URL <http://www.naba.ca>
 - .46 NEMA - National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL <http://www.nema.org>

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- .47 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101 Quincy, Massachusetts, U.S.A. 02269-9101 URL <http://www.nfpa.org>
 - .48 NFSA - National Fire Sprinkler Association, P.O. Box 1000, Patterson, New York, U.S.A. 12563 URL <http://www.nfsa.org>
 - .49 NHLA - National Hardwood Lumber Association, 6830 Raleigh-La Grange Road, Memphis, TN, U.S.A 38184-0518 URL <http://www.natlhardwood.org>
 - .50 NLGA - National Lumber Grades Authority, 406-First Capital Place, 960 Quayside Drive, New Westminster, B.C. V3M 6G2
 - .51 NRC - National Research Council, Building M-58, 1200 Montreal Road, Ottawa, Ontario K1A 0R6 URL <http://www.nrc.gc.ca>
 - .52 NSPE National Society of Professional Engineers, 1420 King Street, Alexandria, VA U.S.A. 22314-2794 URL <http://www.nspe.org>
 - .53 PCI - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, Illinois, U.S.A. 60606-6938 URL <http://www.pci.org>
 - .54 PEI - Porcelain Enamel Institute, PO Box 920220, Norcross, GA U.S.A. 30010 URL <http://www.porecelainenamel.com>
 - .55 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL <http://www.pwgsc.gc.ca/cgsb>
 - .56 RAIC Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, Ontario, K1N 5M3 URL <http://www.raic.org>
 - .57 SCC - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL <http://www.scc.ca>
 - .58 SSPC - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, Pennsylvania 15222-4656 URL <http://www.sspc.org>
 - .59 TPI - Truss Plate Institute, 583 D(Onofrio Drive, Suite 200, Madison, WI, U.S.A. 53719 URL <http://www.tpinst.org>
 - .60 TTMAC - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, Ontario L4K 3E8 URL <http://www.ttmac.com>
 - .61 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062-2096 URL <http://www.ul.com>
 - .62 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL <http://www.ulc.ca>

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.

1.2 RELATED SECTIONS

- .1 Section 01 42 00 – References
- .2 Section 01 79 00 – Demonstration and Training

1.3 REFERENCE STANDARDS

- .1 Within text of each specifications section, reference may be made to reference standards. List of standards reference writing organizations is contained in Section 01 42 00 - References.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, Engineer reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be born by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.4 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to quality or fitness of products, decision rests strictly with Engineer based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Engineer of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Engineer at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Engineer reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time

1.6 STORAGE, HANDLING, AND PROTECTION

- .1 Handle and store products in manner to prevent damage, alteration, deterioration and soiling and in accordance with manufacturer's written instructions when applicable.
- .2 Verify satisfactory delivery of the equipment by completing Form 100, as attached to this Specification.
- .3 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .4 Store products subject to damage from weather in weatherproof enclosures.
- .5 Store cementitious products clear of earth or concrete floors, and away from walls.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Store gasoline and paint products in a secure lockable area.
- .9 Remove and replace damaged products at own expense and to satisfaction of Engineer.
- .10 Touch-up damaged factory finished surfaces to Engineer's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.8 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with Manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from Manufacturers.
- .2 Notify Engineer in writing, of conflicts between specifications and Manufacturer's instructions, so that Engineer may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Engineer to require removal and re-installation at no increase in Contract Price or Contract Time.
- .4 The Contractor shall inform the Engineer, in writing, of the attendance at the site of any Manufacturer's Representative for installation training at least fourteen (14) days prior to arrival.
- .5 When the Manufacturer's Representative is satisfied that the Contractor is aware of all installation requirements, the Manufacturer's Representative shall so certify by completing Form 101 that is attached to the Specification.
- .6 The completed form shall be delivered to the Engineer prior to departure of the Manufacturer's Representative from the site.
- .7 Installation of the equipment shall not commence until the Engineer has advised that the completed Form 101 has been delivered.

1.9 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed.

Immediately notify Engineer if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in their required duties. Engineer reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Engineer, whose decision is final.

1.10 CO-ORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.11 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Engineer if there is interference. Install as directed by Engineer.
- .3 In areas of exposed ceilings install pipes, ducts, equipment and wiring in a neat and organized manner. Inform Engineer if there is interference and do not proceed with work until directed by the Engineer.

1.12 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Engineer of conflicting installation. Install as directed.

1.14 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.15 FASTENINGS – EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Engineer.

1.17 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.
- .3 Coordinate all service disruptions with City operations personnel and obtain their approval prior to interruption.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 77 00 - Closeout Procedures.
- .3 Section 01 79 00 - Demonstration and Training.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Four weeks prior to Substantial Performance of the Work, submit to the Engineer, an electronic copy and four final copies of operating and maintenance manuals in English.
- .3 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .4 Copy will be returned after final inspection, with Engineer's comments.
- .5 Revise content of documents as required prior to final submittal.
- .6 Provide undamaged spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .7 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.4 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Submit in expandable 3-post binders with project name and information embossed on spine and cover.
- .3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text:
 - .1 Provide Manufacturer's printed data, or typewritten data.
- .8 Drawings:
 - .1 Provide with reinforced punched binder tab.
 - .2 Bind in with text; fold larger drawings to size of text pages.
- .9 CAD Files:
 - .1 Provide 1:1 scaled CAD files in dxf format on flash drives.
- .10 Construction Photos:
 - .1 Provide CD of construction photos in sleeve for each binder.
- .11 Warranty and Bond information:
 - .1 Provide each warranty or bond separated with index tab sheets keyed to Table of Contents listing.

1.5 CONTENTS

- .1 Table of Contents:
 - .1 Provide title of project.
 - .2 Date of submission.
 - .3 Names, addresses and telephone numbers of Engineer and Contractor with name of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

- .3 Product Data:
 - .1 Mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings:
 - .1 Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text:
 - .1 As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Warranty and Bond information:
 - .1 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .2 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
 - .3 Verify that documents are in proper form, contain full information, and are notarized.
 - .4 Retain warranties and bonds until time specified for submittal.
 - .5 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .7 Training: Refer to Section 01 79 00 - Demonstration and Training.

1.6 AS-BUILT DOCUMENTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT AS-BUILT" in neat, large, printed letters.
- .4 Maintain as-built documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep as-built documents and samples available for inspection by Engineer.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of full size hardcopy drawings.
- .2 Record changes in red ink.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
- .7 Other Documents: maintain manufacturer's certifications, required by individual specifications sections.
- .8 Electronic 'RECORD DRAWINGS' by Engineer:

- .1 Transfer contractor's "As-Built" Information (red-line revisions) on to electronic drawings in a recent version of AutoCAD. Identify each electronic drawing, in lower right hand corner, in legible font, red ink, as follows: "RECORD DRAWINGS" (This drawing has been revised to show systems as installed).
- .2 Include Contractor's signature and date.

1.8 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system.
 - .1 Give function, normal operation characteristics, and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour code wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements:
 - .1 Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.
- .15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes:
 - .1 Include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
 - .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .3 Moisture-protection and Weather-exposed Products:
 - .1 Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store in location designated by Engineer.
- .4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.11 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store in location designated by the Engineer.

- .4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.12 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING, AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Engineer.

1.14 PRE-WARRANTY CONFERENCE

- .1 Meet with Engineer, to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Engineer.
- .2 Engineer will establish communication procedures for:
 - .1 Notification of construction warranty defects.
 - .2 Determine priorities for type of defect.
 - .3 Determine reasonable time for response.
- .3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue construction warranty work action.
- .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.15 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Engineer.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section describes the general requirements for equipment delivery, installation and performance testing to be performed by the Contractor for all equipment supplied under the Contract.
- .2 At least thirty (30) days prior to commencing equipment Performance Testing and equipment Commissioning, the Supplier shall assist the Contractor to prepare and submit a detailed start-up plan to indicate the schedule and sequence of equipment installation checks and tests required for the Engineer's review and input. No testing work can commence until all parties involved have discussed this plan and the plan has been accepted by the Engineer.

1.2 RELATED SECTIONS

- .1 Section 01 71 00 - Closeout Procedures.
- .2 Section 01 79 00 - Demonstration & Testing.
- .3 Division 40 Process Integration
- .4 Division 46 Water and Wastewater Equipment

1.3 EQUIPMENT DELIVERY

- .1 The General Contractor shall be responsible for receiving, unloading, and storage of Contractor supplied equipment. The General Contractor shall be responsible for loading / unloading and storage of Owner supplied equipment as required.
- .2 The General Contractor shall ensure that all necessary precautions are taken in the loading / unloading of equipment and its subsequent storage.
- .3 The General Contractor shall inspect the contents of Owner supplied equipment and any equipment delivery and be satisfied of the contents thereof and damage which may have occurred during transport.
- .4 When the Engineer, General Contractor and Manufacturer are satisfied that the equipment has been delivered in its entirety without damage, they shall complete the "Certificate of Equipment Delivery" (Form 100) included in this Section.

1.4 INSTALLATION ASSISTANCE

- .1 Before commencing installation of Contractor supplied or Owner supplied equipment, where indicated in the Specifications, the Contractor shall

arrange for the attendance of the Manufacturer's Representative to provide instructions in the methods, techniques, precautions, and any other information relevant to the successful installation of the equipment as required.

- .2 The Contractor shall inform the Engineer, in writing, of the attendance at the site of any Manufacturer's Representative for installation training at least fourteen (14) days prior to arrival.
- .3 When the Manufacturer's Representative is satisfied that the Contractor is aware of all installation requirements, the Manufacturer's Representative shall so certify by completing "Certificate of Equipment Installation Assistance" (Form 101) included in this Section.
- .4 The completed form shall be delivered to the Engineer prior to departure of the Manufacturer's Representative from the site.
- .5 Installation of the equipment shall not commence until the Engineer has advised that the completed Form 101 has been delivered.

1.5 INSTALLATION

- .1 If necessary, or if so directed by the Engineer during the course of installation, the Contractor shall contact the Manufacturer to receive clarification of installation procedures, direction, or any other additional information necessary to continue or complete the installation in an appropriate manner.
- .2 If it is found necessary, or if so directed by the Engineer, the Contractor shall arrange for the Manufacturer's Representative to visit the site to provide assistance during installation, all at no additional cost to the Owner.
- .3 Prior to completing installation, the Contractor shall inform the Manufacturer and arrange for the attendance at the site of the Manufacturer's Representative to verify successful installation.
- .4 The Contractor shall advise the Engineer in writing, at least seven (7) days prior, of the Manufacturer's Representative's scheduled arrival.
- .5 The Manufacturer's Representative shall conduct a detailed inspection of the installation including alignment, electrical connections, belt tensions, rotation direction, running clearances, lubrication, workmanship and all other items as required to ensure successful operation of the equipment.
- .6 The Manufacturer's Representative shall identify any outstanding deficiencies in the installation.
- .7 In the presence of the Manufacturer's Representative, the Contractor, and the Engineer, the equipment shall then be given a one (1) hour trial run.

- .8 If deficiencies noted by the Manufacturer's Representative or which become evident in the trial run prejudice the successful completion of the trial run, the deficiencies will be rectified by the Contractor and the Manufacturer's Representative will be required to re-inspect the installation, at no additional cost to the Owner.
- .9 On successful completion of the trial run in the second or subsequent attempt, the Manufacturer's Representative will certify successful installation by completing the "Certificate of Satisfactory Equipment Installation" (Form 102) that is attached to this Section.
- .10 The completed Form 102 shall be delivered to the Engineer prior to departure of the Manufacturer's Representative from the site.
- .11 Tag the equipment with a 100mm by 200mm blue card stating "Equipment Checked. Do Not Run." stenciled in large black letters. The Contractor shall sign and date each card.

1.6 EQUIPMENT OPERATION AND PERFORMANCE TEST

- .1 Equipment will be subjected to performance tests including a dry test run and a wet test run, after the installation has been verified and any identified deficiencies have been remedied.
- .2 The Contractor shall inform the Engineer at least fourteen (14) days in advance of conducting the tests and arrange for the attendance of the Manufacturer's Representative. The tests may be concurrent with the inspection of satisfactory installation, if mutually agreed by the Contractor and the Engineer.
- .3 The Contractor shall ensure the equipment to be tested is free to all debris, dirt or any items that may adversely affect the equipment and testing process.
- .4 The Contractor shall contact the Manufacturer's Representative to conduct all necessary checks to the equipment and if necessary, advise the Contractor of any further work needed prior to confirming the equipment is ready to run.
- .5 The Contractor shall then notify the Engineer of his readiness to demonstrate the operation of the equipment. The Engineer shall attend, as expeditiously as possible.
- .6 Dry Test Run
 - .1 The dry test run is led by the Manufacturer's Representative and the Contractor. The Engineer and Owner's Designated Staff should be actively involved to ensure they understand the safety checks, hand-off-auto functions, and necessary checks prior to introduction of water

- .2 The Manufacturer's Representative, if required, shall conduct a short dry test run on the equipment. Examples of check performed at this stage include:
 - .1 Alignment and Balancing.
 - .2 Piping connections.
 - .3 Confirmation of electrical and instrument interconnects required to permit operation.
 - .4 Direction of rotation.
 - .5 Testing emergency shutdown switches.
 - .6 Binding or misalignment.
 - .7 If appropriate, code certifications provided.
 - .3 Any deficiencies observed during this inspection, either relating to the installation of the equipment or the equipment itself, would be noted and recorded, and corrected prior to the wet test run.
 - .4 Prior to the wet test run using clean water, all the systems including pipes and tanks will be cleaned of debris, dirt, and any construction material
- .7 Wet Test Run
- .1 The responsibility of the Wet Test Run is shared between the Manufacturer's Representative, the Contractor, the Engineer and the Owner's Designated Staff. The Owner's Designated Staff will perform the safety checks, control functions, and process measurements and equipment checks to ensure each item of equipment conforms to the specifications when operating under load.
 - .2 Examples of checks performed at this stage include:
 - .1 Voltage.
 - .2 Amperage.
 - .3 Operating temperatures (i.e. motors, bearings, VFD cabinets).
 - .4 Vibration measurements.
 - .5 Instrument calibration and loop check-out.
 - .6 Plant Control System (PCS) check-out.
 - .7 Control functions.
 - .8 Pump discharge pressures and volumes.
 - .9 Hydraulics in channels, pipes, through valves or gates.
 - .10 Comparison with any factory test results.
 - .3 The equipment shall then be run for one (1) hour. Local controls shall be satisfactorily verified by cycling the equipment through

several start-stop operations, modulating its output, or some combination. Operating parameters such as temperature, pressure, voltage, vibration, etc., will be checked to ensure that they are within the specified or Manufacturer's recommended limits, whichever is more stringent.

- .4 On satisfactory completion of the one (1) hour demonstration, the equipment will be stopped and critical parameters, such as alignment, will be rechecked.
- .5 The equipment will be restarted and run for seven (7) days, of which the last forty-eight (48) hours shall be consecutive. During this period, as practicable, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed to by the Contractor and Engineer on the basis of the information contained in the Specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.
- .6 Performance tests will be conducted either concurrent with or subsequent to the running test, as practicable and agreed between the Engineer and the Contractor.
- .7 Performance tests shall be as dictated in the Specifications for each item of equipment or as reasonably required by the Engineer to prove adherence to the requirements listed in the Specifications.
- .8 The Contractor shall submit the results of the performance tests to the Engineer, documented and summarized in a format acceptable to the Engineer and the Owner. The Engineer reserves the right to request additional testing. No equipment shall be accepted and handed over to the Owner prior to the satisfactory completion of the Equipment Performance Test(s) and acceptance of the test reports by the Engineer
- .9 All water, chemicals, temporary power, heating, or any other ancillary services required to complete the initial demonstration, running test and performance tests are the responsibility of the Contractor.
- .10 The Contractor to provide the initial charges of oil, grease, and all materials necessary for the initial demonstration, running test and performance tests not provided under this Contract, all to the satisfaction of the Equipment Manufacturer.
- .11 Should the Performance Tests reveal any defects, then those defects shall be promptly rectified and the Performance Tests shall be repeated to the satisfaction of the Engineer.

- .12 Additional costs incurred by the Contractor, the Engineer, or the Owner, due to repeat Performance Tests shall be the responsibility of the Supplier.
- .13 On successful completion of the Equipment Performance Tests, the "Certificate of Satisfactory Equipment Performance" (Form 103) attached to this Section will be signed by the Manufacturer's Representative, the Contractor, the Engineer and the Owner.
- .14 Process Performance Testing can commence as soon as the "Certificate of Satisfactory Equipment Performance" (Form 103) is completed.
- .15 The Contractor shall affix to the tested equipment a 100mm by 200mm card reading "Operable Condition - Do Not Operate without Contractor's Permission." stenciled on in large black letters.
- .16 One copy of Form 103 shall be used for each major piece of equipment.

1.7 TRAINING

- .1 Description
 - .1 Contractor is to provide training the City's designated Operator Staff, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this Contract.
 - .2 For equipment that is specified to include training, arrange for the attendance of the Manufacturer's Representative to provide classroom training session(s) to operating staff. Give the Engineer at least thirty (30) days notice of the session(s).
 - .3 Coordinate the training session(s) with the Manufacturer.
 - .4 As a minimum, the Contractor is to allow at least four (4) hours of training per Operator, as required for each item of equipment or system. Refer to the equipment specifications for specific time periods.
 - .5 The presentations shall be given during the three (3) week period preceding the start of the seven (7) day operating period required for Form 103.
 - .6 The intent is that the Operator Staff should receive sufficient training on the equipment system that they are going to operate and maintain. The Engineer shall have the authority to determine the duration and content of each training session required.
- .2 Quality Assurance
 - .1 Where required by the equipment specifications, provide on-the-job training of the Operator Staff. Training sessions will be conducted

by qualified, experienced two (2) years minimum, factory-trained representatives of the various equipment suppliers. Training includes instruction of Operator Staff in equipment operation and preventive maintenance and instruction on mechanics, electronics, and instrumentation and communications equipment operators (technicians) in normal maintenance up to major repair.

- .2 The trainer(s) proposed by the Contractor shall be experienced in "training" plant operators and shall have relevant experience in similar work.

.3 Submittals

- .1 Submit the following information in accordance with Section 01 33 00. For phased testing and start-up activities, separate submittals can be prepared for equipment items or systems. The material will receive a "NO EXCEPTIONS TAKEN" or "MAKE NOTED CORRECTIONS" status by the Engineer no later than four (4) weeks prior to delivery of the training:

- .1 Lesson plans and training manuals, handouts, visual aids, and other reference materials for each training session to be conducted by the Contractor's trainer(s).
- .2 Date, time, and subject of each training session.
- .3 Training schedule. Concurrent classes will not be allowed.

- .2 The Contractor and Manufacturers Representative will be responsible to document each training session with a detailed set of minutes and provide five (5) sets of training seminar manuals at the end of the project in similar format to the O&M Manual.

.4 Location

- .1 Where specified, conduct training sessions for the Operator Staff, operation and maintenance personnel, on the operation, care, and maintenance of the equipment and systems installed under this Contract. Training will take place at the site of the Work and under the conditions specified herein.
- .2 Field training sessions will take place at the site of the equipment. Classroom training to take place in a location agreed upon with the City.
- .3 Inform the Engineer of any requirements for audio-visual aids five (5) days before training session

.5 Lesson Plans

- .1 Prepare formal written lesson plans for each training session and coordinate with the Engineer. Lesson plans to contain an outline of the material to be presented along with a description of visual aids

to be utilized during the session. Each plan will contain a time allocation for each subject. Furnish ten (10) copies of necessary training manuals, handouts, visual aids and reference materials at least two (2) weeks prior to each training session.

.6 Format and Content

.1 Include time in the classroom and at the location of the equipment or system for each training session. Allow thirty (30) minutes at the beginning of the first period for the Engineer to provide a summary of the design intent relating to that equipment. Following the engineering design overview, provide as a minimum, cover the following topics for each item of equipment or system:

- .1 Familiarization
- .2 Safety
- .3 Operation
- .4 Troubleshooting
- .5 Preventive maintenance
- .6 Corrective maintenance
- .7 Parts
- .8 Local representatives.

.7 Video Recording

.1 The Owner may record each training session. After taping, the material may be edited and supplemented with professionally produced graphics to provide a permanent record for the Owner's use. Advise all suppliers providing training sessions that the training material may be videotaped.

.8 Training

.1 General Requirements

- .1 Conduct initial training in conjunction with the Equipment Performance Testing periods. Schedule classes such that classroom sessions are interspersed with field instruction in logical sequence. Arrange to have the training conducted on consecutive days, with no more than four (4) hours of classes scheduled consecutively.
- .2 Provide final Operating and Maintenance Manuals, as defined in Section 01 33 00, for the specific equipment to the Owner at least four (4) weeks prior to the start of any training. Videotaping may take place concurrently with all training sessions.

.2 Operator Classroom Training

.1 As a minimum, classroom equipment training for operations personnel will include:

- .1 The equipment's specific location in the plant and an operational overview. Use slides and drawings to aid discussion.
- .2 Purpose and plant function of the equipment.
- .3 The operating theory of the equipment.
- .4 Start-up, shutdown, normal operation, and emergency operating procedures, including system integration and electrical interlocks, if any.
- .5 Safety items and procedures.
- .6 Routine preventive maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
- .7 Operator detection, without test instruments, of specific equipment trouble symptoms.
- .8 Required equipment exercise procedures and intervals.
- .9 Routine disassembly and assembly of equipment if applicable for purposes such as operator inspection of equipment.

.3 Operator Hands-On Training

.1 As a minimum, hands-on equipment training for operations personnel will include:

- .1 Identifying instrumentation: location of primary element; location of instrument readout; discuss purpose, basic operation, and information interpretation.
- .2 Discussing, demonstrating, and performing standard operating procedures and daily visual inspection of system operation.
- .3 Discussing and performing the preventive maintenance activities.
- .4 Discussing and performing start-up and shutdown procedures.
- .5 Performing the required equipment exercise procedures.

- .6 Performing routine disassembly and assembly of equipment if applicable.
 - .7 Identifying and reviewing safety items and performing safety procedures, if feasible.
- .4 Maintenance Classroom Training
 - .1 Classroom equipment training for the maintenance and repair personnel will include:
 - .1 Basic theory of operation.
 - .2 Description and function of equipment.
 - .3 Routine start-up and shutdown procedures.
 - .4 Normal and major repair procedures.
 - .5 Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
 - .6 Routine and long-term calibration procedures.
 - .7 Safety procedures.
 - .8 Preventive maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to and including major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
- .5 Maintenance Hands-On Training
 - .1 Hands-on equipment training for maintenance and repair personnel will include:
 - .1 Locating and identifying equipment components.
 - .2 Reviewing the equipment function and theory of operation.
 - .3 Reviewing normal repair procedures.
 - .4 Performing routine start-up and shutdown procedures.
 - .5 Reviewing and performing the safety procedures.
 - .6 Performing Owner-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.
 - .7 Reviewing and using Supplier's manuals in the hands-on training.

.9 Training Completion Forms

- .1 **Form T1:** To be completed for initial training during Equipment Performance Testing.
- .2 **Form T2:** To be completed for final training during the Process Performance Testing.
- .3 A sample of **Forms T1** and **T2** are attached to this specification section.
- .4 One copy of **Forms T1** and **T2** will be required for each major piece of equipment.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

**CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100**

The undersigned certifies that the equipment listed below has been delivered into the care of the Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: Iqaluit Wastewater Treatment Plant Upgrade

**ITEM OR
EQUIPMENT:** _____

TAG No: _____

**REFERENCE
SPECIFICATION:** _____

MANUFACTURER'S REPRESENTATIVE **DATE**

CONTRACTOR'S REPRESENTATIVE **DATE**

ENGINEER **DATE**

CERTIFICATE OF EQUIPMENT INSTALLATION INSTRUCTION

FORM 101

The undersigned has familiarized the Contractor of the specific installation requirements related to the equipment listed below and is satisfied that the Contractor understands the required procedures.

PROJECT: Iqaluit Wastewater Treatment Plant Upgrade

**ITEM OR
EQUIPMENT:** _____

TAG No: _____

**REFERENCE
SPECIFICATION:** _____

MANUFACTURER'S REPRESENTATIVE DATE

CONTRACTOR'S REPRESENTATIVE DATE

CERTIFICATE OF SATISFACTORY EQUIPMENT INSTALLATION

FORM 102

The undersigned has completed a check and inspection of the installation listed below and confirms that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: Iqaluit Wastewater Treatment Plant Upgrade

**ITEM OR
EQUIPMENT:** _____

TAG No: _____

**REFERENCE
SPECIFICATION:** _____

MANUFACTURER'S REPRESENTATIVE DATE

CONTRACTOR'S REPRESENTATIVE DATE

ENGINEER DATE

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE

FORM 103

The undersigned certifies that the equipment listed below has been continuously operated for the time period specified and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: Iqaluit Wastewater Treatment Plant Upgrade

**ITEM OR
EQUIPMENT:** _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

MANUFACTURER'S REPRESENTATIVE **DATE**

CONTRACTOR'S REPRESENTATIVE **DATE**

ENGINEER **DATE**

**CERTIFICATE OF SATISFACTORY INITIAL TRAINING
FORM T1**

We certify that the initial training for the equipment listed below has been provided as per the specifications.

PROJECT: Iqaluit Wastewater Treatment Plant Upgrade

**ITEM OR
EQUIPMENT:** _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

TRAINER'S REPRESENTATIVE

DATE

OWNER'S REPRESENTATIVE

DATE

ENGINEER

DATE

**CERTIFICATE OF SATISFACTORY FINAL TRAINING
FORM T2**

We certify that the final training for the equipment listed below has been provided as per the Specifications.

PROJECT: Iqaluit Wastewater Treatment Plant Upgrade

**ITEM OF
EQUIPMENT:** _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

TRAINER'S REPRESENTATIVE

DATE

OWNER'S REPRESENTATIVE

DATE

ENGINEER

DATE

Part 1 General

1.1 SECTION INCLUDES

- .1 This section describes the general requirements for system commissioning and handover to be performed by the General Contractor for all equipment supplied under the Contract.
- .2 At least thirty (30) days prior to commencing equipment Performance Testing and equipment Commissioning, the Supplier shall assist the General Contractor to prepare and submit a detailed start-up plan to indicate the schedule and sequence of equipment installation checks and tests required for the Engineer's review and input. No testing work can commence until all parties involved have discussed this plan and the plan has been accepted by the Engineer.

1.2 RELATED SECTIONS

- .1 Section 01 71 00 - Closeout Procedures.
- .2 Section 01 79 00 - Demonstration & Testing.
- .3 Division 40 Process Integration
- .4 Division 46 Water and Wastewater Equipment

1.3 DEFINITIONS

- .1 System: For the purpose of this specification section, a system shall be defined as the equipment, piping, controls, ancillary devices, electrical power, etc. which together perform a specific function at the facility.
- .2 Commissioning: For the purpose of this specification section, commissioning shall be defined as the successful operation of a system in accordance with its design requirements for a period of twenty-eight (28) days, the last seven (7) of which shall be consecutive.
- .3 Acceptance: For the purpose of this specification section, Acceptance shall be defined as the formal turnover of a system to the Owner for his operation and maintenance. This shall occur after the end of commissioning of each system once the Engineer, the Owner, and the Contractor have signed the "Certificate of Satisfactory Process Performance" (Form 104).

1.4 COMMISSIONING TEAM

- .1 The work of commissioning will be conducted by teams comprised of personnel from the Contractor, Manufacturer's Representative, the Owner, and the Engineer.

- .2 The Engineer shall be responsible for the direction of the commissioning work and shall have ultimate authority.
- .3 The plant operations staff shall represent process personnel and operating staff and/or maintenance staff.
- .4 The Contractor shall provide personnel representing the appropriate trades, including control and instrumentation personnel during the commissioning work. These personnel shall be skilled workmen, able to expedite any minor repairs, adjustments, etc. as are required to complete commissioning with as few delays as possible.

1.5 COMMISSIONING OBJECTIVES

- .1 To bring mechanical, electrical and building architectural systems and components from a state of static completion to a state of dynamic operation.
- .2 To verify conformance to contract requirements.
- .3 To confirm installations, meet requirements and design intent of contract drawings and specifications.
- .4 To ensure completed facility meets user stated requirements.
- .5 To review and assemble written verification that training was conducted for all systems being commissioned. The training is to be of sufficient quality and depth ensuring that facility staff have all the needed information to effectively operate and maintain all commissioned systems.
- .6 To verify accuracy and completeness of as-built drawings and Operations & Maintenance Manuals with regards to the commissioned systems.

1.6 COMMISSIONING PLAN

- .1 The Commissioning Team shall develop a detailed methodology for the commissioning of each System at least forty-five (45) calendar days prior to planned start of commissioning work. The commissioning plan shall be drafted by the Contractor and include the following:
 - .1 Detailed schedule of events, including but not limited to the schedule for completion of testing of all component parts of the System.
 - .2 Method for introducing flow, disposing of partially treated effluent, and disposing of any sludge or other residual solids generated during the commissioning process. The Contractor will take responsibility for the implementation of these measures.
 - .3 Planned attendance schedule for Manufacturer's Representatives.
 - .4 Contingency plans in the event of a process malfunction.

- .5 Drawings and sketches as required illustrating the planned sequence of events.
 - .6 List and details for all temporary equipment required to facilitate commissioning work.
 - .7 List of all personnel who the Contractor plans for the commissioning work and hand-over with information indicating their qualifications for this work.
- .2 The Commissioning Plan shall be reviewed and accepted by the Commissioning Team prior to its implementation. The Engineer shall be the final arbiter.

1.7 SYSTEMS TO BE COMMISSIONED

- .1 The Commissioning Team shall provide reviews and or commissioning services for:
- .1 All process mechanical treatment systems.
 - .2 All HVAC mechanical systems and components
 - .3 All electrical systems and components.
 - .4 Building architectural systems and components

1.8 PREPARATION REQUIREMENTS PRIOR TO COMMISSIONING

- .1 All process, mechanical, electrical, control and miscellaneous equipment related to a system shall be successfully installed and tested in accordance with Section 01 79 00 and any specific requirements noted in other divisions. Form 103 shall be executed for piece of equipment.
- .2 Owner's staff training sessions shall be completed (Forms T1 and T2)
- .3 Temporary equipment will be installed and tested as necessary to ensure that it functions reliably and consistently through the commissioning period.
- .4 Operating and Maintenance manuals shall have been submitted and accepted.
- .5 Piping, wiring, and other conduit systems shall be finished and tested.
- .6 Electrical connections shall be completed and inspected to the satisfaction of the governing authorities.

1.9 CO-ORDINATION

- .1 Prior to commencement of each particular testing procedure, contractor to co-ordinate all sub-trades, manufacturers, suppliers and other specialties to ensure all phases of work are properly completed. Establish necessary manpower requirements.

1.10 CONTROLS

- .1 All controls which are the responsibility of this Contractor shall be installed and tested prior to commissioning, with all related control software debugged.
- .2 The Engineer shall arrange for the simulation of the control sequences or shall allow for the operation of the system without the features included in the work of others. Every effort shall be made to ensure that the commissioning period provides for the full and comprehensive operation of the equipment under all anticipated normal and adverse operating conditions.

1.11 COMMISSIONING COSTS

- .1 Contractor to pay all costs associated with starting, testing, adjusting, preparation for balancing and cleaning, including supply of instruments, equipment, supplies, and consumable materials.

1.12 MANPOWER

- .1 The Contractor in shall supply staff required during commissioning as necessary to assist the Owner's staff in the operation of the plant.
- .2 The Contractor in shall supply competent staff capable of maintaining, repairing and adjusting the equipment and controls to achieve the intended design functions during the commissioning period.

1.13 OPERATING DESCRIPTIONS

- .1 Operating descriptions have been prepared for the plant systems. To some degree, the intent of these have been included in the drawings and technical specifications. Other information outlining the operating requirements is available in preliminary form at the office of the Engineer. The Contractor will review these descriptions and will make himself familiar with the requirements in order that he can undertake commissioning in an appropriate manner.

1.14 DESIGN PARAMETERS

- .1 Design parameters for the systems to be commissioned shall be as defined in the specifications and/or the operating descriptions; as modified by the Commissioning Team.
- .2 The Commissioning Team will identify to the Contractor which parameters shall be modified prior to commissioning and shall be responsible for any subsequent changes during the commissioning period.

1.15 SEQUENCE

- .1 Systems shall be commissioned in a logical manner. Upstream components shall be commissioned first to the degree possible.
- .2 The following sequence of events shall be followed:
 - .1 Draft O & M Manuals shall be available at least one (1) month prior to the performance tests.
 - .2 Operating Descriptions shall be made available two (2) weeks prior to testing.
 - .3 Initial operator training shall be undertaken two (2) weeks prior to commissioning.
 - .4 Raw wastewater shall be introduced to the system.
 - .5 Start and run system in manual mode.
 - .6 Turn separate items of equipment to automatic in a planned and logical manner. Ensure that the control system is operating the equipment in a manner which precludes damage of the equipment and which is consistent with the process operating requirements.
 - .7 Commence commissioning period of twenty-eight (28) days. The equipment shall operate continuously and successfully through the last seven (7) days of a commissioning period. Minor failures shall not void the commissioning period. A minor failure is defined as one which does not present a safety hazard, does not impact overall process functioning and can be temporarily overcome by the use of available standby equipment. The last seven (7) days of the commissioning period shall be restarted if a critical failure occurs. A critical failure shall be deemed as one which prohibits the process from functioning successfully for an eight (8) hour period or one which creates a safety hazard.
 - .8 Upon completing the commissioning period, the system shall be granted formal acceptance.

1.16 COMMISSIONING

- .1 Raw wastewater will be introduced to the system in a manner which precludes the damage of any equipment or structures.
- .2 During the commissioning period, plant component settings will be modified to ensure that the system is subjected to flows and loads as close to design conditions as possible. Where necessary to achieve this, flows to the area being commissioned will be augmented to exaggerate the naturally occurring flows and loads. Where it is necessary to modify settings outside the limits of this contract area within the plant, coordinate the changes with plant staff.

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- .3 The Contractor shall assist in the operation of the plant to achieve the process objectives.
 - .4 All components and systems shall be operated in the automatic/manual and the remote/local modes as required to prove proper operation.
 - .5 The Contractor shall ensure all backup provisions function satisfactorily.
 - .6 All minor and major alarm conditions will be induced to ensure that the process reacts as intended, the applicable alarms are enunciated.
 - .7 Testing of the equipment, at this time, shall include, where applicable, but not limited to, the following:
 - .1 Hydraulic capacities
 - .2 Preliminary checks on process efficiency
 - .3 Instrumentation and control system checks
 - .4 Hand/Off/Auto Safety Devices are operational
 - .5 Operations and maintenance schedules for equipment during testing all phases
 - .6 Start-up, operation and shutdown (a minimum of four times) of all fossil fuel systems
 - .7 All noted deficiencies are to be noted, in writing, by the Contractor and passed to the Manufacturer for correction. A copy of which is to be provided to the Engineer. All costs associated with the rectification of such deficiencies shall be completed at no cost to the Owner.

1.17 ACCEPTANCE

- .1 The commissioning of a system shall be considered acceptable when the process has operated in a stable manner, satisfying the design criteria for a period of twenty-eight (28) days, the last seven (7) of which shall be consecutive.
- .2 When a process system has been commissioned satisfactorily, the process system shall be formally accepted for operation and routine maintenance by the Owner's forces. Upon Acceptance, the "Certificate of Satisfactory Process Performance" (Form 104) will be signed.
- .3 The Contractor is advised that commencement of the Warranty Period is tied to the issuance of the Notice of Acceptance and shall not commence until that milestone is achieved.
- .4 An Acceptance Meeting must be held at the end of the twenty-eight (28) day test to confirm the status of each system.

- .5 Notice of Acceptance for the entire project will be granted when all systems have been commission and accepted, and all requirements and all requirements of the General Conditions have been completed.

1.18 COMMISSIONING MEETINGS

- .1 Attendance at commissioning meetings will be required throughout the construction process. At all meetings, a minimum attendance of a qualified representative of all identified contractors and subcontractors is required. The following meetings are to be included in the commissioning process:
 - .1 Commissioning kick off meeting:
 - .1 This meeting will be completed through tele or video conferencing. Representatives for the Contractors Commissioning Team are required to attend. Details of the tele or video conferencing will be provided 14 days prior to the meeting.
 - .2 Commissioning field review:
 - .1 Within 90 days of the commissioning startup there will be a commissioning field review on site to review the construction progress, schedule and commissioning requirements. This meeting will be coordinated to take place concurrent with a regular construction process field review.
 - .3 Commissioning Test Planning and Scheduling Meeting:
 - .1 Within 30 days of the start of the commissioning verification process a dedicated Test Planning and Scheduling meeting will be completed to coordinate the commissioning verification process. This meeting will be completed through tele or video conferencing. Representatives for the Contractors Commissioning Team are required to attend. Details of the tele or video conferencing will be provided 14 days prior to the meeting.
 - .4 Commissioning verification (site testing) coordination meeting:
 - .1 This meeting will take place on site during the site testing and verification.
 - .5 Commissioning verification (site testing) wrap up meeting.
 - .1 This meeting will take place on site on completion of the site testing and verification.
 - .2 Commissioning meeting attendance:
 - .1 General contractor.
 - .2 Mechanical contractor.
 - .3 Sheet metal contractor.

- .4 EMCS/BMS contractor.
- .5 Electrical contractor.
- .3 Unless otherwise noted meetings will be held at the site offices of the General Contractor.

1.19 QUALITY ASSURANCE

- .1 Contractor to use personnel for testing, starting and operating equipment through the commissioning process who have experience in applicable equipment and systems commissioning, and are able to interpret results of readings and tests and report state of systems in a clear and concise manner.

1.20 STARTING & TESTING PHASES

- .1 After each distinct phase of work has been completed, correct deficiencies before commencing the next phase.

1.21 SPECIALTY AGENCIES & TESTING LABORATORIES

- .1 Contractor to arrange for reports prepared by special testing agencies and testing laboratories to be submitted to the Commissioning Authority. Include a copy of each report in commissioning report.
- .2 Agencies and testing laboratories shall have facilities and qualifications acceptable to the Commissioning Authority.

1.22 SCHEDULING

- .1 Commissioning services will be scheduled to occur in a seamless and continuous manner immediately after a successful interim substantial completion.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

**CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE
FORM 104**

The undersigned has certifies that the equipment listed below has been operated and tested as per the Specifications using process water and that the equipment meets its Performance Testing Criteria. The equipment is therefore classed as “conforming”.

PROJECT: Iqaluit Wastewater Treatment Plant Upgrade

**ITEM OR
EQUIPMENT:** _____

TAG No: _____

**REFERENCE
SPECIFICATION:** _____

MANUFACTURER'S REPRESENTATIVE DATE

CONTRACTOR'S REPRESENTATIVE DATE

ENGINEER DATE

DIVISION 40 – PROCESS INTEGRATION

PART 1 GENERAL

1.1 Section Includes

- .1 This section specifies general clauses applicable to the supply and installation of all process mechanical systems.
- .2 The process mechanical systems include all the systems handling process fluid and those directly related to the process system.
- .3 The Work under this section must include the supply, installation, testing and start-up of the Process Mechanical Material and Products to provide a complete and workable installation in accordance with the contract drawings and specifications and all applicable codes, standards and ordinances. Any work and/or other necessary materials not specifically mentioned in the specifications or shown on the drawings, but necessary to complete the installation, must be furnished by the Contractor as if specifically mentioned herein and detailed.

1.2 Reference Standards

- .1 The Local Standards and Guidelines for Municipal Water Supply, Wastewater and Storm Drainage Facilities, must apply to the work of this Section.
- .2 Welding must conform to the ANSI/ASME Power Piping Code and the ASME Boiler and Pressure Vessel Code.
- .3 Welders must be qualified and licensed in Nunavut, and welder qualifications must be in accordance with CSA-Z662.
- .4 Welding safety requirements must be in accordance with CSA-W117.2 - Code for Safety in Welding and Cutting.
- .5 Work must be performed in accordance with the Regulations of the Occupational Health and Safety Act.
- .6 Installation must be in accordance with the National Building Code and all regulations and codes of the Province, Territory or Municipality in which the work is located

1.3 Definitions and Interpretations

- .1 Where the term "Provide" is used herein, it must be understood to include labour, materials, and services necessary to supply items or work referenced.
- .2 Where the terms "Instructions" or "As Instructed" or "Where Instructed", are used herein, they must be understood to mean as instructed by the Engineer including supplementary instruction notices and all comments made regarding submittals of Shop Drawings and samples for review.
- .3 Where the term "Listed" is used herein, it must be understood to mean that the materials or equipment have been tested in accordance with applicable standards and methods, have been approved and listed for the intended use by a

testing authority which itself has been approved by the authorities having jurisdiction.

- .4 Where the terms "Approved", or "Approval", are used herein, they must be understood to mean approved by Authorities having jurisdiction as conforming to Codes, Standards, Bylaws, etc.
- .5 Where the terms "Acceptable", or "Acceptance", are used herein, they must be understood to mean acceptable to the Engineer as generally conforming to the requirements of the contract documents.
- .6 Where the term "Submit for Review" is used herein, it must be understood to mean submit to the Engineer.
- .7 Where the term "Subject to Review" etc. is used herein, it must be understood to mean work must be laid out for review by the Engineer. No work must proceed until instructions have been obtained from the Engineer. Submit further information, Shop Drawings, samples, etc. as specified and/or as may be reasonably requested by the Engineer.
- .8 Where the term "Accessible" is used herein, it must be understood to mean readily approachable by person or tools as required and where obstacles may be removed and replaced without cutting or breaking out materials.
- .9 Where working pressure or pressure ratings are specified or shown on the drawings for valves, piping, fittings, equipment, etc., these items must be suitable for operating at specified pressures and corresponding temperature unless noted otherwise.
- .10 The process mechanical drawings do not show structural details and any information involving accurate measurements of buildings. Refer to architectural and structural drawings as well as all other divisions of this specification.
- .11 Piping and mechanical work must be painted in accordance with the painting specifications presented in Section 40 05 30 and in accordance with this specification with regard to pipe identification.

1.1 Shop Drawings

- 1.1.1 Refer to Section 01 33 00 for the general requirements for Shop Drawings.
- 1.1.2 In addition to the requirements of Section 01 33 00, submit the following specific information with Shop Drawings.
 - .1 Assembly Drawings showing details of connections and termination of equipment for connection by others.
 - .2 List of materials of construction, detailing the component parts and reference specifications (ASTM, CSA, ANSI, etc.).
 - .3 Motor operating data, including motor and insulation ratings, start-up and operating current ratings, operating voltage and amperage tolerances, and description of construction, complete with illustrative Drawings.
 - .4 Gearbox and drive data, including AGMA/AFBMA ratings for components, materials of construction, tolerances and description of construction.

- .5 Control schematics, text and wiring diagrams as required to describe control operations. Where large instrumentation and control schematics are required as part of the submission, submit samples of the Drawings prior to the full submission.
- .6 Required ancillary services including but not limited to electrical, non-potable water and drains.
- .7 Installation instructions indicating assembly and mounting requirements, alignment and assembly tolerances and points of connection for ancillary services.
- .8 Start-up instructions including lubricant requirements, electrical requirements, status and operability of instrumentation and control functions.
- .9 Details of coating systems to be applied.
- .10 Details of insulation provided to prevent galvanic corrosion between mating surfaces constructed of dissimilar metals.
- .11 A copy of the related Technical Specification Section with addenda updates, with each paragraph check marked to show compliance or marked to show deviations.

1.2 Submittals for Information Only

1.2.1 Spare Parts Lists

- .1 Spare parts required within first year of operation that are not listed in specific equipment Sections.
- .2 Spare parts required within first 5 years of operation.

1.3 Operating and Maintenance Data

1.3.1 Provide, for all equipment included in the supply, all information to be incorporated into the operation and maintenance manual as specified in Section 01 78 00. Include the following, in addition to the information specified in Section 01 78 00 and the specific information listed for various equipment items in the specific Specifications:

- .1 Complete description of operation and maintenance procedures and requirements.
- .2 General arrangement and detailed Drawings.
- .3 Wiring diagrams for power and control schematics (if required).
- .4 Parts catalogues with complete list of repair and replacement parts with section drawings, illustrating the connection and the parts manufacturer's identifying numbers.
- .5 Preventative maintenance requirements.

1.4 Pre-Selected or Pre-Purchased Equipment

1.4.1 The Contractor must:

- .1 Install, test, and commission pre-selected or pre-purchased equipment.

- .2 Review all information available for pre-selected or pre-purchased equipment and become familiar with requirements for storage, installation, testing, and commissioning.
- .3 Accept delivery of the pre-selected or pre-purchased equipment according to the Supply Contracts or as mutually agreed upon by the Contractor, the Engineer, and the supplier.
- .4 Upon delivery, fully inspect the item of equipment in the presence of the Owner and a Manufacturer's Representative. Where the equipment requires modification or repair to properly function, these items will be identified to and confirmed by the Engineer.
- .5 Any repairs identified that have resulted from shipping and handling prior to the pre-selected or pre-purchased equipment arriving on site will be identified to the Supplier and the hauler for their rectification.
- .6 After the equipment is delivered on site, the Contractor will install, and commission the equipment with the input of the Supplier provided as per the Supply Contract documents.
- .7 Minor changes necessary to accommodate the exact dimensions and arrangement of the pre-selected or pre-purchased equipment are the responsibility of the Contractor and the supplier of the equipment.

1.4 Delivery, Storage, and Handling

- .1 All materials and equipment must be delivered, handled and stored subject to the provisions contained herein and per the manufacturer's recommendations.
- .2 Provide temporary storage facilities and heated storage where required for sensitive items such as motors.
- .3 Equipment, including pumps and motors, must not be placed in temporary or final locations in the new structures before approval by the Engineer. The date of delivery into the structure must be commensurate with the construction progress and the suitability, with respect to temperature, humidity, etc. of the building.
- .4 Take precautions to maintain equipment in good condition and to avoid corrosion or other damage which may affect the equipment's performance. Provide temporary coatings as required to prevent corrosion.
- .5 Leave factory covers in place and prevent entry of foreign materials into working parts of equipment.
- .6 Protect members and bearings with plastic covers.
- .7 Grease all shafts and sheaves to prevent corrosion.
- .8 The Contractor must recognize the time interval required for complete construction before the structure is suitable for equipment installation. If equipment is delivered before it is required at the site, the Contractor must provide suitable heated dry storage space for the equipment, to the approval of the Engineer. All rotating equipment and motors must be rotated at least weekly

during the storage period, and after installation, until the equipment is placed in normal use.

- .9 All material damaged or otherwise harmfully affected during delivery, storage, handling or installation must be replaced by the Contractor at his/her own expense.

1.5 Approved Alternatives

- .1 Approval of alternative equipment must be in accordance with the Goods and Services Terms and Conditions.
- .2 Equipment shown on the drawings and specified is the recommended equipment and is to be used unless permission for an approved equivalent alternate is obtained.

1.6 Temporary Usage

- .1 Temporary usage by the Owner of any process device, apparatus, machinery or equipment prior to interim or final inspection is not to be construed as acceptance.

1.5 Coordination

- 1.5.1 Coordinate the requirements of the equipment supplied with equipment housekeeping pads, piping, structural supports, drainage, ventilation/cooling, electrical service, instrumentation and control interface and other ancillaries specified in other Divisions.

1.6 Tagging Instructions

- 1.6.1 Tag loose items associated with a particular unit with the equipment number. Make tagging materials of aluminum or stainless steel (no plastic) and securely attach to each item.

PART 2 PRODUCTS

2.1 Spare Parts

- 1.6.2 Supply spare parts as required in the various Technical Specification Sections. The lists in these Sections are intended to include all parts, which normally would be required within a single year for normal preventative maintenance and where fabrication requirements for special parts would delay delivery and could keep an item of equipment out of service for an extended period.
- 1.6.3 Identify any special spare parts not listed. Include a price list.
- 1.6.4 Provide a list of all spare parts, not including lubricants, which normally would be required through the first five (5) years of operation. Provide prices for each part, guaranteed for two (2) years after Project completion.
- 1.6.5 Replenish any spare parts used in the initial year of operation at the end of the maintenance period for the related item(s) of equipment.

2.2 Flanges and Pipe Threads

- .1 Provide flanges on cast iron equipment and appurtenances that conform in dimension and drilling to ANSI B16.1, Class 125 and flanges on steel equipment and appurtenances that conform in dimension and drilling to ANSI B16.5, Class 150 otherwise specified.
- .2 Provide pipe threads that conform in dimension and limits of size to ANSI B1.1, coarse thread series, Class 2 fit.
- .3 Provide flange assembly bolts that are heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Provide threads that conform to Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

2.3 Bearings

- .1 Unless otherwise specified, provide oil or grease lubricated, ball or roller type equipment bearings, designed to withstand the stresses of the service specified. Rate each bearing in accordance with ABFMA Methods of Evaluating Load Ratings of Ball and Roller Bearings.
- .2 Provide equipment bearings that have a minimum L-10 rating life of 50,000 hour, as determined using the maximum equipment operating speed, unless otherwise specified.
- .3 Fit grease lubricated bearings, except those provided factory sealed and lubricated, with easily accessible grease supply, flush, drain, and relief fittings. Use extension tubes where necessary. Provide standard hydraulic alemite type grease supply fittings.
- .4 Equip oil-lubricated bearings with either a pressure lubricating system or a separate oil reservoir type system. Provide each oil lubrication system to be of sufficient size to absorb the heat energy generated in the bearing under a maximum ambient temperature of 40°C. Provide a filler pipe and an external level indicator gauge.

2.4 V-Belt Assemblies

- .1 Select belt for not less than 150% of rated driver power. Where two sheave sizes are specified, ensure belt sizing is appropriate for both sets.
- .2 For explosion-proof equipment, use anti-static type belts.
- .3 Statically balance sheaves and bushings. Where sheaves and bushings are to operate at peripheral speeds greater than 1650 m/min, dynamically balance the assembly.
- .4 Separately mount sheaves on their bushings by means of three pull-up grub or cap tightening devices. Key seat bushings to the drive shaft.

2.5 Couplings

- .1 For equipment with drives over 0.375 kW and less than 120 kW, and where the driver is directly connected to the driven unit, provide a flexible coupling. Couplings must accommodate angular misalignment, parallel misalignment, and end float and must cushion shock loads and dampen torsional vibrations.
- .2 The flexible member of flexible couplings must consist of a tire, with synthetic tension members bonded together in rubber. Attach the flexible member to flanges by means of clamping rings and cap screws, and attach the flanges to the stub shaft by means of taperlock bushings. Provide the equivalent of a shrunk-on fit. There will be no metal-to-metal contact.
- .3 For larger couplings, provide continuous sleeve flexible gear type, forged steel couplings.
- .4 Size each coupling as recommended by the coupling manufacturer for the specific application, considering applied power, speed of rotation, type of service and other pertinent details.

2.6 Guards

- .1 On moving parts, provide sheet steel guards in accordance with workplace safety regulations. Fabricate of 14 gauge steel and galvanize after construction.
- .2 Guards must be removable to facilitate maintenance of moving parts.

2.7 Equipment Supports, Anchors, Bases

- .1 The Contractor must provide all structural work required for foundation and support of units, foundation bolts, sleeves, washers, nuts, shims and templates to locate bolts.
- .2 Anchor bolts must be set in concrete with one end of the bolt hooked as detailed; or sleeved anchor bolts as detailed in the drawings may be set in concrete. Expansion type bolts drilled into concrete must not be used in lieu of anchor bolts.
- .3 Provide a minimum of 25 mm non-metallic grout between bedplates and concrete foundation, fill voids, finish and remove wedges after grout is set. Grout must be Embeco or approved equivalent alternative, non-metallic type.
- .4 Where grouting is required for bedplates and equipment bases on concrete foundations, the surface of the concrete foundation must be roughened to provide a bond.
- .5 All bases must be finished to match the floor finish.

2.8 Painting

- .1 Piping and valves must be painted in accordance with paint specifications in Section 40 05 30.

- .2 All unpainted equipment and appurtenances must be given shop prime paint suitable for field painting as specified in Section 40 05 30.
- .3 Hangers, supports and fabricated equipment must be primed and painted as specified in Section 40 05 30.
- .4 Equipment having a finished shop coat must be touched up.
- .5 Do not paint over nameplates.

2.9 Identification of Equipment

- .1 Provide a manufacturer's nameplate on each piece of equipment.
- .2 Provide system nameplates on each piece of mechanical equipment as follows:
- .3 Minimum size 75 mm x 35 mm x 2.5 mm thick laminated plastic with black face and white centre. Letters to be 6 mm high.
- .4 Identify each piece of equipment by type and number.

2.10 Identification of Piping

- .1 All piping must be color coded in accordance with the code shown in Section 40 05 30.
- .2 Colors will be primary colors, numbered in accordance with CGSB Standard Paint Colors.
- .3 The entire length of each pipe will be painted in the basic color, with bands to indicate the specific fluid and an arrow to indicate flow direction.
- .4 Bands must be 25 mm wide.
- .5 Use standard plastic color bands and marker tags on small piping.
- .6 Direction arrows must be black 150 mm x 25 mm.
- .7 Arrows must be painted at each branch and termination point.
- .8 Locate markers from usual operating areas and identify piping runs at least once in each room and where piping enters or leaves a room.

2.11 Valve Directories

- .1 Tag all valves and floor stands to the corresponding valve number.
- .2 Tags must be 20 mm brass, lamacoid, metal photo or aluminum tags with black numbers, secured to the valve stem with a key chain.
- .3 Tag automatic controls, instruments and relays and key to control shop drawing identification numbers. Tag all equipment excluding pipes and ducts.

2.12 Electric Starting Switch Identification

- .1 Identify electric starting switches, remote push button stations and equipment supplied under this division with lamacoid plates having 6 mm minimum letter size. Identification to state equipment controlled.

2.13 Motors

- .1 Motors supplied for Process Mechanical equipment must be suitable for hard, continuous service according to EEMAC and CSA Standards and must operate free of vibration.
- .2 Motors must be drip proof open type, submersible, or explosion proof as required for the service indicated. Under full load the motor temperature rise must not exceed 40°C for open types and 50°C for enclosed types.

2.14 Cutting and Patching

- .1 Refer to Part I – Scope of Work which must apply to the work of this section.
- .2 The Contractor must locate and provide holes and sleeves for all process mechanical work in accordance with the contract drawings and specifications, and in accordance with Part I – Scope of Work.

PART 3 EXECUTION

3.1 Installation

- .1 Follow the recommended installation details and procedures for all equipment as found in the supplier's technical data, supplemented by the shop drawings, the contract drawings and the specifications and the directions of the Engineer.
- .2 Install mechanical work in advance of concrete pouring as necessary.
- .3 For equipment or material of the same type or classification, install only products of one manufacturer.
- .4 Install all equipment with adequate access for inspection and servicing.
- .5 Employ only skilled tradesmen properly licensed by the Province or Territory, for all work requiring tradesmen with special skill.
- .6 Motors must be aligned, shimmed and coupled to fit shafts, to the tolerances given by the manufacturer.
- .7 Set equipment in place and install piping, fittings, valves and other items. Make final adjustments in alignment and elevation before securely fastening equipment and other items in place.
- .8 Control alignment so that excess forces are not imposed on equipment when piping connections are tightened.
- .9 Do not tighten pipes until grout is set.
- .10 Tighten so that there are no excessive stresses set up in flanges.

3.2 Vibration Isolation

- .1 Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.

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- .2 Provide flexible connectors for pipes to all equipment supported by vibration isolators.
 - .3 Provide flame proof flexible connectors between fans, heaters, equipment and ducts.
 - .4 Equipment installed by the Contractor must operate smoothly without excessive wear, adjustment and attention. Vibration must not exceed the manufacturer's specified limits for individual products. Vibrations in pumps must be within acceptable field vibration limits as outlined in the Standards of the Hydraulics Institute.

3.3 Cleanup and Disinfection

- .1 All piping and equipment must be thoroughly cleaned of dirt, cuttings and other foreign substances.
- .2 Disconnect, clean and reconnect whenever necessary for purposes of locating and removing obstructions.
- .3 Flush and chlorinate all potable water systems as specified in plumbing codes and where applicable, in accordance with AWWA standards for Disinfection of Facilities.

3.4 Lubrication

- .1 For all equipment furnish all lubricants used during testing and trial runs.
- .2 For equipment supplied by the Contractor, furnish lubricants in sufficient quantity for 12 months operation by the Owner.
- .3 Identify lubricants furnished by brand, grade and item of equipment for which it is intended.
- .4 Operate, drain and flush out bearings and refill with a new change of oil before completion.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 This section describes the pipe materials, fittings, appurtenances, installation and testing of the process mechanical systems.
- .2 Use the general requirements specified in this section integrally with the more specific requirements listed in Section 40 05 13.01 – Detailed Piping Specification Sheet.
- .3 Piping supports are generally not shown on the process mechanical layout drawings. Provide the design of piping supports, pipe guides, expansion joints and anchors based upon final piping layout. Typical support details and structural attachments shown on the drawings indicate the level of quality that will be considered acceptable.
- .4 The Contractor must provide the necessary submittals and ensure the proper registration of piping systems and system components as required by the Local Boilers Safety Association.
- .5 Standard of Acceptance: Items specified by manufacturers name and/or catalogue number form part of this specification in order to define the standard regarding performance, quality of material and workmanship. When used in conjunction with a referenced standard, must be deemed to supplement the standard.

1.2 Reference Standards

- .1 Conform to the most recent version of the following reference standards:
 - .1 ANSI/API 609, Lug and Wafer-Type Butterfly Valves
 - .2 ANSI/ASME A13.1, Scheme for the Identification of Piping Systems.
 - .3 ANSI/ASME B1.20.1, Pipe Threads, General Purpose.
 - .4 ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 - .5 ANSI/ASME B16.3, Malleable Iron Threaded Fittings Class 150 and 300.
 - .6 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.
 - .7 ANSI/ASME B16.9, Factory-Made Wrought Steel Butt Welding Fittings.
 - .8 ANSI/ASME B16.10, Face and End-to-End Dimensions of Valves
 - .9 ANSI/ASME B16.11, Forged Steel Fittings, Socket Welding and Threaded.
 - .10 ANSI/ASME B16.12, Cast Iron Threaded Drainage Fittings.
 - .11 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .12 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

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- .13 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .14 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .15 ANSI/ASME B31.1, Power Piping.
 - .16 ANSI/ASME B31.3, Process Piping.
 - .17 ANSI/ASME B31.9, Building Services Piping.
 - .18 ANSI/ASME B36.10M, Welded and Seamless Wrought Steel Pipe.
 - .19 ANSI/ASME B36.19M, Stainless Steel Pipe.
 - .20 ANSI/AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
 - .21 ANSI/AWWA C110, Ductile-Iron and Grey-Iron Fittings, 3 Inch through 48 Inch, for Water and Other Liquids.
 - .22 ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Grey-Iron Pipe and Fittings.
 - .23 ANSI/AWWA C115, Flanged Ductile-Iron and Grey-Iron Pipe with Threaded Flanges.
 - .24 ANSI/AWWA C151 (ANSI A21.51), Ductile-Iron Pipe, Centrifugally Cast in Metal Moulds or Sand-Lined Moulds, for Water and Other Liquids.
 - .25 ANSI/AWWA C200, Steel Water Pipe, 6 Inches and Larger.
 - .26 ANSI/AWWA C203, Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - .27 ANSI/AWWA C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 Inches through 144 Inches.
 - .28 ANSI/AWWA C206, Field Welding of Steel Water Pipe.
 - .29 ANSI/AWWA C207, Steel Pipe Flanges for Waterworks Services - Sizes 4 Inch Through 144 Inch.
 - .30 ANSI/AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings.
 - .31 ANSI/AWWA C209, Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines.
 - .32 ANSI/AWWA C210, Liquid Epoxy Coating System for the Interior and Exterior of Steel Water Pipe.
 - .33 ANSI/AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
 - .34 ANSI/AWWA C219, Bolted, Sleeve-Type Couplings for Plain End Pipe.
 - .35 ANSI/AWWA C301, Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
 - .36 ANSI/AWWA C303, Reinforced Concrete Pressure Pipe - Steel Cylinder Type, Pretensioned, for Water and Other Liquids.
 - .37 ANSI/AWWA C508, Swing-Check Valves for Waterworks Services, 2 In (50 mm) through 24 In (600 mm) NPS.
 - .38 ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and their Appurtenances.

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- .39 ANSI/AWWA C606, Grooved and Shouldered Joints.
 - .40 ANSI/AWWA C651, Disinfecting Water Mains.
 - .41 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches through 12 Inches, for Water.
 - .42 ANSI/AWWA C906, Standard for Polyethylene (PE) Pressure Pipe and Fittings 4 Inches through 63 Inches, for Water Distribution.
 - .43 ANSI/AWWA M11, Steel Pipe - A Guide for Design and Installation.
 - .44 ASME Section IX, Boiler and Pressure Vessel Code; Welding and Brazing Requirements.
 - .45 ASTM A47, Malleable Iron Castings.
 - .46 ASTM A53/A53M, Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
 - .47 ASTM A74, Cast Iron Soil Pipe and Fittings.
 - .48 ASTM A105/A105M, Forgings, Carbon Steel, for Piping Components.
 - .49 ASTM A106, Seamless Carbon Steel Pipe for High Temperature Service.
 - .50 ASTM A126, Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .51 ASTM A135, Electric-Resistance-Welded Steel Pipe.
 - .52 ASTM A139, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over).
 - .53 ASTM A167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - .54 ASTM A181/181M, Carbon Steel for General Purpose Piping.
 - .55 ASTM A182/182M, Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - .56 ASTM A193/193M, Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.
 - .57 ASTM A194/194M, Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.
 - .58 ASTM A197, Cupola Malleable Iron.
 - .59 ASTM A234/A234M, Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
 - .60 ASTM A240/A240M, Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and General Applications.
 - .61 ASTM A269, Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .62 ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes.
 - .63 ASTM A285/A285M, Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength.
 - .64 ASTM A307, Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
 - .65 ASTM A312/312M, Seamless and Welded Austenitic Stainless Steel Pipe.
 - .66 ASTM A320/320M, Alloy Steel Bolting Materials for Low-Temperature Service.

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- .67 ASTM A351/A351M, Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts.
 - .68 ASTM A380, Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems.
 - .69 ASTM A395/A395M, Ferritic Ductile Iron Castings for Use at Elevated Temperatures.
 - .70 ASTM A403/A403M, Wrought Austenitic Stainless Steel Piping Fittings.
 - .71 ASTM A409/A409M, Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service.
 - .72 ASTM A480/A480M, General Requirements for Flat-Rolled Stainless and Heat- Resisting Steel Plate, Sheet, and Strip.
 - .73 ASTM A536, Ductile Iron Castings.
 - .74 ASTM A563, Carbon and Alloy Steel Nuts.
 - .75 ASTM A570/A570M, (now A1011/A1011M), Structural Steel, Sheet and Strip.
 - .76 ASTM A743/A743M, Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Applications.
 - .77 ASTM A774/A774M, As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
 - .78 ASTM A778, Welded, Unannealed Austenitic Stainless Steel Tubular Products.
 - .79 ASTM A967, Chemical Passivation Treatment for Stainless Steel Parts.
 - .80 ASTM B32, Solder Metal.
 - .81 ASTM B62, Composition Bronze or Ounce Metal Castings.
 - .82 ASTM B85, Seamless Copper Tube.
 - .83 ASTM B88, Seamless Copper Water Tube.
 - .84 ASTM B152, Copper Sheet, Strip, Plate, and Rolled Bar.
 - .85 ASTM B564, Copper Alloy Sand Castings for General Applications.
 - .86 ASTM C76, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - .87 ASTM C564, Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - .88 ASTM D638, Test Method for Tensile Properties of Plastics.
 - .89 ASTM D792, Test Method for Specific Gravity and Density of Plastics by Displacement.
 - .90 ASTM D1248, Polyethylene Plastics Moulding and Extrusion Materials.
 - .91 ASTM D1457, PTFE Moulding and Extrusion Materials.
 - .92 ASTM D1599 – Standard Test Method for Short-Time Hydraulic Failure Pressure or Plastic Pipe, Tubing and Fittings.
 - .93 ASTM D1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - .94 ASTM D1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

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- .95 ASTM D2105, Standard Test Method for Longitudinal Tensile Properties of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Tube.
 - .96 ASTM D2241, Polyvinyl Chloride (PVC) Pressure-Rated Plastic Pipe (SDR Series).
 - .97 ASTM D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - .98 ASTM D2466, Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
 - .99 ASTM D2467, Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
 - .100 ASTM D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
 - .101 ASTM D2529, Standard Practice for Measuring Beam Deflection for Reinforced Thermosetting Plastic Pipe Under Full Bore Flow.
 - .102 ASTM D2564, Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe Systems.
 - .103 ASTM D2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
 - .104 ASTM D2665, Polyvinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - .105 ASTM D2774, Underground Installation of Thermoplastic Pressure Piping.
 - .106 ASTM D2996, Filament-Wound "Fiberglass" (Glass-Fibre-Reinforced Thermosetting-Resin) Pipe.
 - .107 ASTM D3212, Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals.
 - .108 ASTM D3261, Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Fittings.
 - .109 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.
 - .110 ASTM D4024, Standard Specification for Reinforced Thermosetting Resin (RTR) Flanges.
 - .111 ASTM D4101, Propylene Plastic Injection and Extrusion Materials.
 - .112 ASTM D4174, Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems.
 - .113 ASTM F441/F441M, Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80.
 - .114 ASTM F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - .115 ASTM F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR).
 - .116 Based on outside Diameter.
 - .117 ASTM F894, Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

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- .118 CGA, Canadian Gas Association Standards.
 - .119 CAN/CGA B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .120 CAN/CGA B105 - Installation Code for Digester Gas and Landfill Installations.
 - .121 CAN/CSA B139, Installation Code for Oil Burning Equipment.
 - .122 CAN/CSA B149.1, Natural Gas and Propane Installation Code.
 - .123 CAN/CSA B137.1, Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services.
 - .124 CAN/CSA B137.2, PVC Injection Moulded Gasketed Fittings for Pressure Applications.
 - .125 CAN/CSA B137.3, Rigid PVC Pipe for Pressure Applications.
 - .126 CAN/CSA B181.2, PVC Drain, Waste, and Vent Pipe and Pipe Fittings.
 - .127 CAN/CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).
 - .128 CSA B52, Mechanical Refrigeration Code.
 - .129 CSA CAN3-Z299.3, Quality Assurance Program.
 - .130 CISPI 301, Specification Data for Hubless Cast Iron Sanitary System with No-Hub Pipe and Fittings.
 - .131 CPC, Canadian Plumbing Code.
 - .132 EJMA STDS-93, Standards of Expansion Joint Manufacturers' Association, Edition No. 6.
 - .133 Fluid Sealing Association Technical Handbook, Rubber Expansion Joint Division.
 - .134 FEDSPEC, L-C-530B(1), Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy.
 - .135 MIL-H-13528B, Hydrochloric Acid, Inhibited, Rust Removing.
 - .136 MIL-S-8660C, Silicone Compound.
 - .137 MIL-STD-810C, Environmental Test Methods.
 - .138 MSS SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .139 MSS SP-42, Class 150 Corrosion Resistant Gate, Globe, Angle and Check Valves with Flanged and Butt Weld Ends.
 - .140 MSS SP-43, Wrought Stainless Steel Butt Welding Fittings.
 - .141 MSS SP-67, Butterfly Valves.
 - .142 MSS SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .143 MSS SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .144 MSS SP-72, Ball Valves with Flanged or Butt-Welding Ends for General Service.
 - .145 MSS SP-78, Cast Iron Plug Valves, Flanged and Threaded Ends.
 - .146 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - .147 MSS SP-81, Stainless Steel, Bonnetless, Flanged, Knife Gate Valves.

- .148 MSS SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.
- .149 MSS SP-88, Diaphragm Type Valves.
- .150 MSS SP-99, Instrument Valves.
- .151 MSS SP-108, Resilient-Seated Cast Iron – Eccentric Plug Valves.
- .152 MSS SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- .153 MSS SP-118, Compact Steel Globe Check Valves.
- .154 MSS SP-122, Plastic Industrial Ball Valves.
- .155 NACE RP0178, Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service.
- .156 SAE J1227, Assessing Cleanliness of Hydraulic Fluid Power Components and Systems.
- .157 SSPC-P3, Canadian Government Standards Board.
- .158 SSPC-SP6, Canadian Government Standards Board.
- .159 SSPC-SP10, Canadian Government Standards Board
- .160 Plastics Pipe Institute's PPI Handbook of Polyethylene Piping, chapter "Underground Installation of PE Piping" and chapter "Specifications, Test Methods and Codes for Polyethylene".
- .161 Provincial Building Code.
- .162 Provincial Plumbing Code.

1.3 Definitions and Interpretations

- .1 Pressure terms used in this and other related sections are defined as follows:
 - .1 Operating Limits: The minimum and maximum pressure at which the piping system operates for sustained periods of time.
 - .2 Test pressure: The hydrostatic pressure used to determine system compliance.
- .2 Unless otherwise specified or shown, the interface between piped commodities common to process/mechanical and yard piping is below grade and 0.45 m from the exterior face of a building or tunnel wall.
- .3 Pipe and appurtenance location terms used in this and other related sections are defined as:
 - .1 Tunnels, Pumphouse and Buildings: Within an environmentally controlled enclosure where temperature is maintained above 5° Celsius.
 - .2 Exposed, Aboveground: Outside or within an enclosure which is not environmentally controlled so that the temperature is maintained above 5° Celsius. For the purpose of defining exterior protection systems, this definition is extended to vertical piping to a point of 0.5 m below finished ground level.

- .3 Underground (or buried): Placed in soil and not tied to structures.
- .4 Below Structures: Below concrete slabs such as tanks, channels, buildings, pipe chases, foundation slabs, etc., but not including roadways or walkway structures.
- .5 Submerged: Regularly or occasionally immersed in liquid; inside tanks and/or channels, and within 3.0 m above maximum water level of open tankage. Includes pipe and appurtenances within manholes, vaults and chambers.

1.4 Delivery, Storage, and Handling

- .1 All materials and equipment must be delivered, handled and stored subject to the provisions contained herein and per the manufacturer's recommendations.
- .2 Provide temporary storage facilities and heated storage where required for sensitive items such as motors.
- .3 Equipment, including pumps and motors, must not be placed in temporary or final locations in the new structures before approval by the Engineer. The date of delivery into the structure must be commensurate with the construction progress and the suitability, with respect to temperature, humidity, etc. of the building.
- .4 Take precautions to maintain equipment in good condition and to avoid corrosion or other damage which may affect the equipment's performance. Provide temporary coatings as required to prevent corrosion.
- .5 Leave factory covers in place and prevent entry of foreign materials into working parts of equipment.
- .6 Protect members and bearings with plastic covers.
- .7 Grease all shafts and sheaves to prevent corrosion.
- .8 The Contractor must recognize the time interval required for complete construction before the structure is suitable for equipment installation. If equipment is delivered before it is required at the site, the Contractor must provide suitable heated dry storage space for the equipment, to the approval of the Engineer. All rotating equipment and motors must be rotated at least weekly during the storage period, and after installation, until the equipment is placed in normal use.
- .9 Design Requirements
- .10 The design has been completed to the degree necessary for the Contractor to tender the project. It is not fully detailed and will require the Contractor to undertake design of and responsibility for minor aspects for the piping systems to be installed.
- .11 All process piping must meet requirements of the Process Piping Code, B31.3, whether or not it falls within the Code scope. ABSA must be the Code Authority

whenever the piping system falls within the Code scope. The Engineer must be the Code Authority for process piping that does not fall within the Code scope.

- .12 Piping and Instrumentation drawings, piping schematics, and piping layout drawings are contained in the drawing set. The Piping and Instrumentation Drawings (P&IDs) indicate all major pipework, valves, and appurtenances (other than cleanouts, purge points, etc.). The layout drawings indicate the Engineer's concepts and are intended to illustrate a constructible method for the piping systems. Some appurtenances, supports, guides and anchors, and expansion joints are not fully shown. The Contractor's design will complement and detail these drawings.
- .13 It is understood that some conflicts will arise that will require that the Contractor re-route some of his piping to allow for the installation of wiring, ventilation duct, or similar.
- .14 The Contractor is required to engage a Professional Engineer, registered with NAPEG (Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists) to be responsible for the final aspects of the design. The components of the design that will be generated will be as follows:
 - .1 Final layout, illustrated using layout and isometric drawings.
 - .2 Piping flexibility and stress analysis proving that the allowable stresses prescribed by the Process Piping Code B31.3 are not exceeded under any prescribed combination of conditions, and indicating the forces and moments in each direction under each condition at each support, guide or anchor.
 - .3 Piping support system design, including details and spacing of all supports. The support system will ensure that the weight of the pipework and the need for lateral and vertical support are considered fully.
 - .4 Expansion and contraction design, including the layout and details for all necessary expansion joints needed to compensate for thermal expansion and contraction, structural movement, and the isolation of equipment.
 - .1 Failure of piping or supports from overstress or fatigue.
 - .2 Leakage at joints.
 - .3 Detrimental stresses or distortion in piping and valves or in connected equipment or piping systems not designed by the Contractor's Engineer, resulting from excessive thrusts and moments in the piping.
 - .5 For the FOA pipe system, in addition to clauses presented above, the Contractor's engineer is to review the structural details for the anchors, supports and guides and advise of any concerns or modifications required to the anchors, supports and guides. The Contractor's engineer is also to determine the location of supports, anchors, guides and expansion joints. The Engineer (Owner's engineer) will confirm that the originally designed

supports, anchors and guides in the Contract are sufficient to meet the forces and moments provided by the Contractor's engineer.

- .15 Design documentation will be submitted to the Engineer as necessary to indicate compliance with the requirements of the piping systems. The documentation will be stamped and sealed by an Engineer registered with NAPEG (Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists). The Engineer stamping the drawings must provide evidence of experience with such systems.
- .16 Note that for large diameter, thin walled [thickness less than one (1%) percent of diameter] piping comprehensive flexibility and stress analysis is required, even if the design met the exception granted under Section 319.4.1(c) of the Process Piping Code B31.3.

1.5 Submittals

- .1 For each piping system, submit documentation listing pipe, fittings, flexible connectors, expansion joints, linings, coatings, and valving to be used for each pipe size and category.
- .2 Radiographic Weld Testing: Submit the name and qualifications of at least two independent firms for the radiographic weld testing to be undertaken by the Contractor if and as required by the applicable Code. The selected firm will be subject to the review and acceptance of the Engineer
- .3 A copy of this specification section and all referenced sections with each paragraph check- marked to show compliance or highlighted to indicate deviation.
- .4 For all pipe greater than or equal to 50 mm diameter, submit isometric drawings, to indicate the assembly details, the welds, flanges, valve placement, cathodic protection, expansion joints, guides, anchors, hangers, supports, and the provisions for thrust restraint, as well as any other pertinent details
- .5 Submit piping layout drawings by plant area which indicate location and placement of valves, fittings and other appurtenances for all piping, greater or equal to 150 mm diameter, in that area. Indicate location and clearances from structures and other utilities (ductwork, conduit, electrical tray, etc.).
- .6 Submit copies of all original submittals and all related correspondence made as part of the regulatory submission required by the Local Boilers Safety Association and any submissions required by other regulatory authorities.
- .7 Product Samples: Where specified or when directed by the Engineer, provide mill test results or product samples.
- .8 Provide hanger, guide, anchor, support system design details including locations, load information, design calculations and illustrative drawings, stamped and signed by a professional engineer registered with NAPEG (Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists).

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- .9 For expansion joints submit manufacturer's catalogue data, shop drawings and assembly drawings confirming general arrangement, dimensions, tolerances, materials of construction, weights and installation details. Submit calculations to substantiate expansion joint selection and amount of precompression, stamped and signed by a professional Engineer registered with NAPEG (Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists).
 - .10 Welding: Prior to commencing any welding of stainless steel pipe, prepare and submit to the Engineer a written description of welding techniques including but not limited to materials, methods, and quality control. Identify differences in shop and field techniques. Written procedures will be stamped and sealed by a professional engineer registered with NAPEG (Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists) and qualified for welding design. For stainless steel welds exposed to process fluids, the weld procedure should provide for maximizing the corrosion resistance of the final weld as well as providing the mechanical strength required.
 - .11 Radiographic weld test results.
 - .12 Prior to the commencement of welding, submit current and complete documentation of the welder's qualifications.
 - .13 For the FOA pipe system, in addition to clauses 1.5.1 to 1.5.12, the FOA expansion joint shop drawings are to be submitted at the same time as the FOA pipe system submittals. Neither shop drawing will be reviewed without the other. The FOA pipe system isometrics are to show dimensions based on the pipe installation temperature, and identify the breach openings at the expansion joints at the installation temperature.
 - .14 For the FOA pipe system, in addition to clauses 1.5.1 to 1.5.12, the FOA anchors, supports and guides shop drawings are to be submitted at the same time as the FOA pipe system submittals. Neither shop drawing submittal will be reviewed without the other.

1.6 Coordination

- .1 Process and Utility Piping Identification
 - .1 Refer to Section 40 05 40 for process piping identification.
- .2 Process and utility piping is identified in the drawings by a two component alpha-numeric code, (Line Label) as follows:
 - .1 The first component of the code indicates the nominal line size.
 - .2 The second component of the code identifies the process fluid being conveyed, (Commodity).
 - .3 The process fluid (Commodity) codes are defined in the drawings.

- .3 Detailed process pipe specifications are provided for each commodity in Section 40 05 13.01.
- .4 Routing: Coordinate piping installation routes and elevations with installation of sheet metal, process equipment, HVAC, instrumentation, and electrical work.
- .5 Pipe Sleeves: Coordinate with other divisions, prior to construction, to locate and place sleeves in cast-in-place concrete. Also, prior to construction of masonry building elements.
- .6 Coordinate with Division 13 to provide correct piping configuration for primary instrumentation elements. For example, provide required minimum straight run of pipe upstream and downstream of flow meters. Coordinate with Division 13 for meter manufacturer's requirements.

1.7 Quality Assurance

- .1 Welding Certification
 - .1 All welders to be certified under the Nunavut Boilers Branch Safety Act and Regulations. As a minimum, welders will hold a Level B Journeyman Welder's Certificate.
 - .2 All welders who work on this project must provide the correct documentation.
 - .3 Welders working on stainless steel piping must not work on welding of any other material.
 - .4 Tools used for stainless steel piping welding must be new and marked for this use. These tools must not be used for any other work. Tools must not be made of materials that could contaminate the stainless steel surface
- .2 Weld Tests
 - .1 All piping welds must be one hundred (100%) percent visually inspected by a registered inspector and any imperfections must be made good as required by the applicable Code and to the satisfaction of the Engineer.
 - .2 For piping required by the applicable Code to be subject to radiographic inspection, or for welds not found satisfactory during the Engineer's visual inspection provide for one (1) full circumference radiographic inspection for every twenty (20) welded pipe-to-pipe and pipe-to-fitting joints. All sizes and types of pipe welds to be tested at locations identified by the Engineer.
 - .3 Contractor to provide for one (1) full circumference radiographic inspection for every twenty (20) welded pipe-to-pipe and pipe-to-fitting joints. All sizes and types of pipe welds to be tested at locations identified by the Engineer.
 - .4 Have radiographic test firm evaluate welds in accordance with ANSI/ASME B31.3 Process Piping Code Normal Service and prepare report summarizing results.

- .5 Have radiographic weld test report, complete with results, submitted directly to Engineer.
- .6 For each defective weld, three additional radiographic inspections at locations identified by the Engineer, will be required plus a radiograph of the repair.
- .3 Regulatory Submissions
 - .1 Complete all regulatory submissions as required by the Nunavut Power Engineers and Boiler Pressure Vessel Safety Act and Regulations.
 - .2 Complete all other submissions as required by other regulatory authorities.

1.8 Conflicts

- .1 Review the drawings prior to installation of piping, conduit services, and fixtures by this or any other division. Identify any conflicts and cooperate with the Engineer to determine the adjustments necessary to resolve these conflicts.
- .2 Confirm the routing of each section of pipework with other services prior to commencement of installation. Advise the Engineer of any conflicts with existing services or services yet to be installed. Where necessary, amend the routing of pipework to avoid conflict and confirm with the Engineer.

1.9 Shipment, Protection and Storage

- .1 Refer to Section 01600 for Shipment and Storage
- .2 Deliver pipe, fittings, and specials to site using loading methods which do not damage pipe or coatings.
- .3 Piping materials delivered to site will be clearly marked to indicate size, type, class/schedule and coatings.
- .4 Until ready for incorporation in the work, store on site as recommended by the piping materials manufacturer to prevent damage, undue stresses, or weathering.
- .5 Store materials at least 200 mm above ground with sufficient supports to prevent undue bending.
- .6 Protect non-UV light inhibited plastic from sunlight.
- .7 Ship pipe expansion joints, anchors, guides and flexible connectors pre-assembled to the degree which is practical.
- .8 Provide shipping devices to maintain the face-to-face dimension of each expansion joint during shipment, storage and installation. Design and place shipping devices so as not to inhibit installation of the joints

1.10 Warranty

- .1 Provide the Owner with a materials and labor warranty for the work. Contractor must supply new materials and re-do the work should materials be found to be defective or not in compliance with the specifications, or should the workmanship be found to be inadequate or the work was not performed in accordance with the specifications and referenced standards, codes and regulations. This warranty must remain in effect for the maximum period of time allowed under Law.
- .2 Neither Engineer's inspections, checks, or any other tests or subsequent authorization to proceed with the work, nor Engineer's waiving of Engineer's right to perform such tests, nor Engineer's decision not to solicit submission of material certificates or other quality assurance documentation relieve the Contractor from any degree of responsibility in regard to the Work or the corresponding warranty above. Contractor agrees that Engineer's ability to fully assess the suitability of materials, work procedures, worker qualifications and other relevant issues is limited. Contractor bears full responsibility and is solely liable in these matters.
- .3 The use of faulty materials or materials that do not meet the specifications and referenced standards, codes and regulations must constitute a hidden defect.
- .4 Employment of labour not properly qualified, the performance of the work not in accordance with the specifications and the referenced standards, codes and regulations, and the use of inadequate or sub-standard workmanship must constitute hidden defects.

PART 2 PRODUCTS

2.1 Function

- .1 Provide the pipe materials, fittings, and appurtenances as described below, for the piping systems shown.

2.2 Pipe Materials General

- .1 All pipe materials to be new, free from defects and conforming to the reference standards.
- .2 Where any standard referenced has been superseded prior to bidding, the contractor must comply with the new standard.

2.3 Pipe Sizes

- .1 Where the pipe size is not specified, provide pipe with the sizes required by the Local Plumbing Code. For small piping not described by the Local Plumbing Code, use 12 mm nominal diameter.

2.4 Fittings

- .1 General

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- .1 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise.
 - .2 Provide concentric reducers in vertical lines unless indicated otherwise.
 - .3 Provide long radius elbows unless otherwise shown. Provide smooth flow carbon or stainless steel elbows 350 mm and less, to ANSI B16.9. Provide mitered elbows greater than 350 mm, to AWWA C208 unless otherwise shown or specified. Use 3- piece construction unless otherwise shown or specified.
 - .4 Provide fittings in concrete cylinder pipe fabricated from metal plate, cement lined and coated, and in accordance with AWWA C301. Dimensions to AWWA C208.
- .2 Steel Pipelines
- .1 75 mm in diameter or greater: conform to ANSI B16.9, ANSI B16.11 or ANSI B16.5. Provide fittings with a wall thickness equal to or greater than the pipe.
 - .2 Less than 75 mm in diameter: provide threaded malleable iron fittings, conforming to ANSI B16.3.
 - .3 Provide long radius steel grooved-joint fittings conforming to ANSI B16.9 in steel grooved-joint pipeline systems. Grooved joint adapters may be welded to fitting ends; dimension and cut the groove of the adapter in accordance with the coupling manufacturer's recommendations; materials and inside diameter to be the same as the pipe; grind the interior weld smooth and meet the lining manufacturer's recommendations.
 - .4 For steel grooved-joint pipe of diameters of 150 mm and less, the Contractor may provide ductile iron grooved-joint fittings which have an outside diameter equal to the steel pipe diameter. Provide ductile iron to ASTM A536, dimensioned to 1.5 diameter radius bends, and cut grooving dimensions to AWWA C606 IPS dimensions. The lining and coating of the ductile iron fittings must equal the lining and coating of the steel pipeline system.
 - .5 Standard radius elbows to dimensions of ANSI B16.5 may be provided on clean water grooved-joint piping systems only.
- .3 Stainless Steel Pipelines
- .1 Less than 75 mm diameter: Provide fittings of the same class as the pipe, conforming to ASTM A403 and ANSI B16.11.
 - .2 Equal to or greater than 75 mm diameter: Fabricate fittings using similar materials and classes as the pipe and conform to ASTM A774 (scale removed).
- .4 Ductile Iron Pipelines
- .1 For flanged piping systems, provide fittings that conform to ANSI B16.1 and in grooved end or mechanical joint ductile iron pipelines to AWWA C110.

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- .2 For ductile iron grooved-joint pipelines, provide ductile iron grooved-joint fittings which have an outside diameter equal to the pipe diameter. Provide ductile iron to ASTM A536, dimensioned to 1.5 diameter radius bends, and cut grooving dimensions to AWWA C606 IPS dimensions. The lining and coating of the ductile iron fittings must equal the lining and coating of the pipeline system.
 - .5 PVC Pipelines
 - .1 Provide ductile iron fittings that conform to AWWA C110 or provide PVC to CSA B137.3, of the same material and class as the pipe.
 - .6 FRP Pipelines
 - .1 Provide fittings of the same material and class as the pipe. Provide flanges to meet ANSI B16.5 Class 150 bolt hole patterns where applicable. For flanged connections to expansion joints, equipment (i.e., foul air scrubber, foul air blowers, etc.), dampers, specialty fittings, etc., the pipe supplier is to match the bolt hole pattern specified by the equipment/damper/fitting supplier. Bolts, nuts, washers, etc. are to be stainless steel, series 300.
 - .2 Provide adhesive kits suitable for the selected FRP material.
 - .3 Provide a UV resistant barrier or gelcoat to protect outdoors and exposed piping from UV degradation.
 - .7 Copper Pipelines
 - .1 Provide copper fittings in conforming to ANSI B16.26.
 - .2 Couplings for copper connection system must be manufactured from ductile iron conforming to ASTM A536.
 - .8 Polyethylene Pipelines:
 - .1 Provide fittings in the same material and class as the pipe.
 - .2 Thermal butt fusion joints to ASTM D2774
 - .9 Buried Pipeline:
 - .1 For buried piping and piping inside carrier pipes, refer to Division 2 specifications.

2.5 Grooved Piping System – IPS Carbon Steel

- .1 General
 - .1 All grooved components must be of one manufacture and approved for use by the authorities, agencies, codes and standards named in the specifications.
 - .2 All approved manufacturers must be certified to ISO 9001 standards.

- .2 Grooved Couplings
 - .1 Grooved Couplings must be manufactured from ductile iron conforming to ASTM A536.
 - .2 All grooved couplings to be designed with angle pads to provide a rigid joint unless otherwise noted. Standard of Acceptance: Victaulic Style 07 (Victaulic Data Sheet 06.02).
 - .3 Where expansion/contraction or Angular Deflection is designed into pipe system flexible couplings must be used. Standard of Acceptance: Victaulic Style 77 (Victaulic Data Sheet 06.04).
- .3 Grooved Fittings: All grooved fittings to be manufactured from ductile iron conforming to ASTM A536, forged steel conforming to ASTM A234 or carbon steel conforming to ASTM A53. Standard of Acceptance: Fittings manufactured by Victaulic (Victaulic Data Sheet 07.01).
- .4 Bolted Mechanical Branch Connections: Branch connections may be provided by bolted, mechanical branch connections manufactured from ductile iron conforming to ASTM A536 complete with synthetic rubber gaskets approved for line service. Standard of Acceptance: Victaulic Style 920 N (Victaulic Data Sheet 10.01).
- .5 Flange Adapters: For connection to ANSI Class 125/150 or Class 250/300 flanged components, grooved flange adapters manufactured from ductile iron conforming to ASTM A536 or malleable iron conforming to ASTM A47 may be used. Standard of Acceptance: Victaulic Style 741 and Style 743 (Victaulic Data Sheets 06.06 and 06.07).
- .6 Noise and Vibration Attenuation: Where it is necessary to suppress noise or vibrations in piping system, three Victaulic Flexible Grooved couplings may be installed in close proximity to the source of noise/vibration in lieu of Elastomeric Flexible "Arch Type" connectors or Flexible Metal Hose connectors. Standard of Acceptance Victaulic Style 77 (Victaulic Data Sheet 26.04).

2.6 Grooved Piping System – Stainless Steel

- .1 General
 - .1 All grooved components must be of one manufacture and approved for use by the authorities, agencies, codes and standards named in the specifications.
 - .2 All approved manufacturers must be certified to ISO 9001 standards.
- .2 Grooved Couplings
 - .1 Grooved Couplings must be manufactured from Stainless Steel conforming to ASTM A351, ASTM A743 or ASTM A744.
 - .2 Grooved couplings to be designed with angle pads to provide a rigid joint unless otherwise noted. Standard of Acceptance: Victaulic Style 489 (Victaulic Data Sheet 17.25). Note: In some applications painted or

galvanized ductile iron couplings may be used to joint stainless steel pipe. Confirm with Supplier.

- .3 Where Expansion/Contraction or Angular Deflection is designed into piping system flexible couplings must be used. Standard of Acceptance: Victaulic Style 77S and Victaulic Style 475 (Victaulic Data Sheets 17.03 and 17.14).

- .3 Grooved Fittings: All grooved fittings to be manufactured from Stainless Steel conforming to ASTM A312, ASTM A403 or ASTM A774. Standard of Acceptance: Fittings manufactured by Victaulic (Victaulic Data Sheet 17.04).

2.7 Grooved Piping System – AWWA Ductile Iron

.1 General

- .1 All grooved components must be of one manufacture and approved for use by the authorities, agencies, codes and standards named in the specifications.
- .2 All approved manufacturers must be certified to ISO 9001 standards

.2 Grooved Couplings:

- .1 Grooved couplings must be manufactured from ductile iron conforming to ASTM A536. Gaskets must be Grade "M" Flush Seal Halogenated Butyl for water service. Standard of Acceptance: Victaulic Style 31 (Victaulic Data Sheet 23.02).
- .2 For connecting components of IPS dimension to components of AWWA dimension, grooved transition couplings may be used. Gaskets must be Grade "M" Flush Seal Halogenated Butyl for water service. Standard of Acceptance: Victaulic Style 307 (Victaulic Data Sheet 23.03)
- .3 Grooved Fittings: Grooved fittings must be manufactured from ductile iron conforming to ASTM A395, Grade 65-45-12 or ASTM A536, Grade 65-45-12 or cast iron conforming to ASTM A48, Class 30-A. Standard of Acceptance: Fittings manufactured by Victaulic (Victaulic Data Sheet 23.05).
- .4 Flanged Adapters: For connection to ANSI Class 125/150 or Class 250/300 flanged components, grooved flange adapters manufactured from ductile iron conforming to ASTM A395 or ASTM A536 may be used. Standard of Acceptance: Victaulic Style 341 (Victaulic Data Sheet 23.04).

2.8 Grooved Piping System – Cooper Tubing

.1 General

- .1 All grooved components must be of one manufacture and approved for use by the authorities, agencies, codes and standards named in the specifications.
- .2 All approved manufacturers must be certified to ISO 9001 standards.

- .2 Grooved Couplings
 - .1 Grooved couplings must be manufactured from ductile iron conforming to ASTM A536.
 - .2 All grooved couplings to be designed with angle pads to provide a rigid joint unless otherwise noted. Standard of Acceptance: Victaulic Style 606 (Victaulic Data Sheet 22.02).
 - .3 Couplings must be complete with Flush Seal gaskets or equivalent.
- .3 Grooved Fittings: All grooved fittings to be manufactured from wrought copper conforming to ASTM B75, C12200 or ASTM B152, C1100 or cast bronze per ASTM B584. Standard of Acceptance: Fittings manufactured by Victaulic (Victaulic Data Sheet 22.04).
- .4 Flange Adapters: For connection to ANSI Class 125/150 or Class 300 flanged components, grooved flange adapters manufactured from ductile iron conforming to ASTM A536. Standard of Acceptance: Victaulic Style 641 (Victaulic Data Sheet 22.03).

2.9 Gaskets

- .1 For flat faced flanges, use full-face gaskets. For Van Stone, lap joint and raised-face flanges, use full face or ring type gaskets. Conform to ASTM B16.21.
- .2 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosivity of the fluid conveyed in the pipeline. Refer to the detailed pipe specification sheets for the recommended gasket material. Material designations used in the detailed pipe specification sheets are as follows:
 - .1 EPDM: ethylene-propylene-diene-terpolymer 70 durometer.
 - .2 BI. Neoprene: neoprene (black) 70 durometer (not acceptable in stainless steel pipe systems).
 - .3 Nitrile: nitrile (Buna N).
 - .4 SBR: Styrene-butadiene (red).
 - .5 Natural rubber: natural rubber.
 - .6 Compressed synthetic fibres (Kevlar): ASTM F104 (F712400), and neoprene binder: 1.7 MPa (ASTM F152), 0.2 mL/h Leakage Fuel A (ASTM F37).
 - .7 Compressed synthetic fibres (Kevlar): ASTM F104 (F712400) and SBR binder: 1.7 MPa (ASTM F152). 0.1 mL/h Leakage Fuel A (ASTM F37).
 - .8 Gylon - Type 1: Garlock Style 3500. 1.35 MPa (ASTM F152). 0.22 mL/h Leakage Fuel A (ASTM F37).
 - .9 Gylon - Type 2: Garlock Style 3510. 1.35 MPa (ASTM F152). 0.04 mL/h Leakage Fuel A (ASTM F37).
 - .10 CPE - Chlorinated Polyethylene.
- .3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:

- .1 Up to 250 mm pipe diameter; 1.6 mm thick.
- .2 Greater than 250 mm pipe diameter; 3.2 mm thick.
- .4 Unless otherwise specified, minimum gasket material thickness for raised face ring gaskets:
 - .1 Up to 100 mm pipe diameter; 1.6 mm thick.
 - .2 Greater than 100 mm pipe diameter; 3.2 mm thick.
- .5 Grooved type gaskets:
 - .1 Select material as recommended by the manufacturer for the service conditions indicated.
 - .2 Unless otherwise specified; for epoxy lined piping systems for solids carrying liquids, provide end-seal type gaskets.
 - .3 Unless otherwise specified, provide flush seal type gaskets for all other grooved joint systems. Acceptable products: Gustin-Bacon Rigigrip, Victaulic Flush-Seal.

2.10 Bolts and Nuts

- .1 Provide hex head bolts and nuts. Threads to be ANSI B1.20.1, standard coarse thread series.
- .2 For general indoor service, use bolts conforming to ASTM A307, Grade A; nuts conforming to ASTM A563, Gr.A.
- .3 Provide stainless steel bolts, nuts and washers for exposed, submerged, buried and concrete encased service; bolts conforming to ASTM A193, Gr.B8, C1.1; nuts conforming to ASTM A194, Gr.8. Provide these also for connections above normal water level but which may be subjected to direct contact with splashed water.
- .4 Provide hot dip galvanized bolts, nuts and washers for use with hot dip galvanized Van Stone flange back-up rings and Lap-joint flange back-up rings.
- .5 Provide hex nuts equal to or less than 25 mm. Greater than 25 mm, provide heavy hex.

2.11 Cathodic Protection

- .1 Provide cathodic protection of piping, pipe fittings and appurtenances.

2.12 Structural Element Penetrations

- .1 Structural element penetrations are shown and referenced to a detail or Process/Mechanical Standard Details. Where a structural element penetration is not referenced, conform to the Standard Detail relevant to the type of structure, exposure and type of pipe.

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- .2 Provide pipe sleeves capable of supporting the loads applied during placement of concrete or during blockwork erection. Century Line HDPE sleeves with water stop collar may be used where applicable.
 - .3 Supply wall or floor penetrations into submerged areas, under slab areas, and where shown with a 6 mm thick water stop flange at least 50 mm larger than the pipe or pipe sleeve outside diameter (o.d.). Continuously weld the water stop flange, both sides, onto the pipe or pipe sleeve. Fill annular space between the sleeve and pipe, where a sleeve is used, with non shrink grout in accordance with Division 3. Form reglets between the grout and the concrete and between the grout and the pipe, on "wet" sides of the wall penetration. Fill reglet with sealant.
 - .4 For structural concrete wall and floor penetrations of non-insulated pipe between dry areas, furnish a sleeve which has an internal diameter at least 50 mm larger than the o.d. of the pipe. For pipes 75 mm and less furnish a pipe sleeve 25 mm larger than the o.d. of the pipe.
 - .5 For masonry wall penetrations of non-insulated pipe, furnish a sleeve which has an internal dimension of at least 50 mm larger than the pipe o.d. For pipes 75 mm and less furnish a pipe sleeve 25 mm larger than the o.d. of the pipe.
 - .6 A Standard Detail is shown for segmented modular pipe seals. Where this detail is used for the penetration of a wall separating a dry area from an underground area, tighten the bolts from the inner face and fill the outer annular space with grout. Use stainless steel bolts and nuts in penetrations through walls separating underground or exterior areas from any other area. If seepage occurs during the warranty period, the Contractor is responsible for repair and/or replacement, at no cost to the Owner. Do not use this type of wall penetration below maximum ground water level elevation

2.13 Insulation

- .1 Provide insulation with a minimum insulation thickness 25 mm. Use greater thicknesses as recommended by the manufacturer if more than 25 mm is required to lower the outer skin temperature to below 40° Celsius.
- .2 Provide stainless steel bands over the insulation at a maximum of 300 mm centers.
- .3 Provide insulation and recovering for all piping where the pipe surface will sweat, where heat retention is required, and at the locations indicated on the drawings.
- .4 Where pipe runs below ground, continue insulation and recovering to a depth 2.5 m below finished ground surface in grassed areas or 3.0 meters below roads, walkways, and access pads.
- .5 Do not insulate over expansion joints or flexible hose connectors, in order to permit periodic inspection of connector bolting.

- .6 Recover all insulated pipe. Align longitudinal seams in aluminum recovering to shed water. Overlap radial seams a minimum of 50 mm.
- .7 Refer to electrical specifications for electrical heat tracing

2.14 Interior Finishes (Linings)

- .1 General
 - .1 Provide products with factory applied linings and finishes unless otherwise noted. Fittings and pipe of any one pipe system to be lined by the same manufacturer.
 - .2 Do not shop coat the internal surface of stainless steel or plastic piping.
 - .3 Provide No. 1 or No. 2B standard finish for gauge stainless steel pipe, as specified in ASTM A480. Finish heavier pipe to No. 1 mill finish or better, as specified in ASTM A480
 - .4 Unless otherwise specified, finish fittings in the same manner as the pipe run.
- .2 Epoxy, E2a, E2b or E2c
 - .1 Where specified in the detailed pipe specification sheets, apply epoxy to the internal surface of piping in accordance with AWWA C210. Refer to Section 40 05 30.
- .3 Asphaltic Varnish
 - .1 Provide asphaltic varnish as the standard finish for ductile iron and cast iron pipe, in accordance with AWWA C151.
- .4 Cement Mortar Lining
 - .1 Where specified in the detailed pipe specification sheets, apply cement mortar lining and an asphaltic seal to the internal surface of ductile iron piping in accordance with AWWA C104.
 - .2 Where specified in the detailed pipe specification sheets, apply cement mortar lining and an asphaltic seal to the internal surface of steel piping in accordance with AWWA C205.
- .5 Glass Lining
 - .1 Where specified in the detailed pipe specification sheets, apply glass lining to pipe interior in two coats.
 - .2 Sandblast interior pipe surfaces prior to lining application to white metal finish in accordance with SSPC-10.
 - .3 After application of first and each subsequent coat, expose to naturation temperature above 750° Celsius.
 - .4 Finished lining will be:
 - .1 200 to 300 microns thick.

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- .2 Density of 2.5 to 3.0 grams per cubic centimetre.
 - .3 Hardness in excess of 5.0 on the MOHS scale.
 - .4 Capable of withstanding 175°C thermal shock without crazing, blistering, or spalling.
 - .5 No visible loss of surface gloss after immersion in eight (8%) percent sulphuric acid solution at 65°C for a period of ten minutes.
 - .6 No more than zero point zero one (0.01%) percent exposure of the base metal due to defects in the glassed surface
 - .5 Provide sample to Engineer for use as a comparison guide.
 - .6 Acceptable products modified to meet this specification are:
 - .1 Vitco
 - .2 Waterworks
 - .7 The glass lining must provide continuous coverage when tested by a low voltage wet sponge holiday detector, with only isolated voids permitted due to casting anomalies and which represent less than zero point zero one (0.01%) percent of the total glassed surface. Testing procedure and acceptance criteria must be as per "MP-92, Porcelain Enamel Continuity Testing", as listed in Clauses 2.10.5.7.1 – .3.
 - .1 Purpose: Proper application of the Porcelain Enamel Coating provides beneficial long term characteristics of lubricity, adherence, and resistance to corrosion and high temperature. Currently, there is no test method, either destructive or non-destructive, which directly measures these characteristics. Rather, the Industry has developed a testing method utilizing a Holiday Detector, which determines the continuity of the glass lining and indicates the relative quality of the process. This method is commonly referred to as "Spark Test".
 - .8 Test Description
 - .1 Equipment: The equipment consists of a Tinker & Rasor electronic device or equivalent designed to locate holidays (pinholes, voids, ridges, etc.) in the non-conducting Porcelain Enamel Lining. It functions by applying a 67.5 volt potential across the glass lining. Any pinholes or other holidays in the glass lining will close the circuit and produce an audible signal from the detector for any resistance less than 10000 OHMS. The current is applied through a circular sponge which has been wetted using water containing approximately one (1%) percent of a wetting agent such as Kodak "Photo Flo".
 - .2 Procedure: For testing long pipe sections, the diameter of the wetted sponge must exceed the diameter of the pipe so that the sponge is in full circumferential contact with the Porcelain Enamel

Lining of the pipe. The sponge is attached to a rod which allows the sponge to be pushed through at least fifty (50%) percent of the pipe. Any discontinuities will result in an audible signal which will be recorded with regard to position along the pipe. Testing is performed from both ends of the pipe.

- .3 Special techniques are required at the exposed pipe ends which are not enameled. If, due to excess water on the sponge, the electric current short circuits to the end of the pipe resulting in an audible signal (typically within 3" of the end), the test personnel must also make a visual inspection to determine if discontinuities exist.
- .9 Acceptance Criteria: The pipe or fittings as tested by the procedure must be rejected from shipment if testing reveals more than isolated voids due to casting irregularities which represent more than 0.01% of the total glassed surface (no more than 1-2 pinholes per fitting or an average of 5 or less per 20 foot pipe spool). Rejected pipe must be evaluated for additional coating with Porcelain Enamel or for total reblasting, reprocessing, and retesting

2.15 Exterior Finishes – (Coatings) Shop Applied

- .1 Provide products with factory applied coatings and finishes as specified in the detailed pipe specification sheets. If no coating is specified in the detailed pipe specification sheets, refer to Section 40 05 30 for general painting requirements.
- .2 Yellow Jacket
 - .1 High density polyethylene (HDPE) jacket extruded over a mastic base.
 - .2 Manufacture, test, inspect and report procedures to meet or exceed CAN3-Z299.3 (Quality Assurance Program - Category 3).
 - .3 Prior to mastic application, sandblast pipe in conformance with requirements or SSPC SP6.
 - .4 Adhesive consists of arubberized asphalt mastic, non-hygroscopic, formulated for use with Yellow Jacket. Apply to prepared surfaces in thickness exceeding 0.175mm.
 - .5 HDPE has the following minimum properties: Ultimate tensile strength, 21 MPa; Tensile elongation at break, six hundred (600%) percent; Shore "D" hardness, 60; and Brittleness temperature -50° Celsius.
 - .6 Apply HDPE by extruding over adhesive in an even thickness to provide a smooth continuous outer sheath, free of pinholes, bubbles, wrinkles, blisters, cracks, or mechanical damage.
 - .7 Minimum HDPE thickness will be as follows:

Nominal Pipe Diameter	Minimum HDPE Thickness (mm)
20	0.55
25	0.55
30	0.60
40	0.65
50	0.70
65	0.70
75	0.70
100	0.75
150	0.90
200	1.00

- .8 All flaws [up to three (3) per pipe] will be repaired by cutting out each damaged area and applying sealant lined 200 mm diameter patch or heat shrink sleeve not exceeding 400 mm in length. Overlap undamaged area by a minimum of 75 mm around cut out section.
- .9 Where the number of flaws or damaged areas per pipe exceeds three (3) or any flaw is too large to be repaired with a patch or sleeve, the pipe will be rejected.
- .10 Tape Wrap: shop applied tape wrap may be used as an alternative to Yellow Jacket. Two or three layer methods can be used, meeting or exceeding the application and performance requirements of AWWA C214.
- .11 Epoxy, E2a, E2b or E2c
 - .1 Apply epoxy (E2a, E2b or E2c) to the exterior of piping in accordance with AWWA C210. Refer to Section 09900 for details.

2.16 Exterior Finishes – (Coatings) Field Applied

- .1 General
 - .1 Use field applied finishes only for: short lengths of metal pipe in a piping system where the length of pipe which requires coating is less than 3.0 m unless otherwise specified; to repair shop-applied exterior finishes; to make up cutback distances at joints; and for fittings, couplings, valves and other appurtenances.
 - .2 Refer to Division 9 for painting requirements for aboveground piping and piping located in tunnels, buildings, pump houses, and other structures. Also refer to Division 9 for painting requirements for exposed piping within insulated systems.
- .2 Tape Wrap
 - .1 For welded joints on Yellow jacketed pipe and as other indicated locations apply tape to buried pipe and fittings. Use Polyken, Tec-Tape or Denso tape, consisting of primer and tape applied to minimum thickness of 0.90 mm in accordance with AWWA C209.

- .2 For flanged or coupled joints and for fittings use petrolatum primer, mastic and tape; Polyken, Tec-Wrap or Denso, in accordance with AWWA C217.
- .3 Shrink Sleeve
 - .1 As an alternative to tape wrap, shrink sleeves are acceptable if material and method of installation is reviewed and accepted by the Engineer prior to use
- .4 Epoxy, E2a, E2b or E2c
- .5 Apply epoxy, E2a, E2b or E2c, to the exterior of piping in accordance with AWWA C210. Refer to Section 40 05 30.

2.17 Galvanizing

- .1 Where piping is to be galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m².
- .2 All carbon steel parts, such as elements of flanges, anchors, guides and supports must be galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m². Elements welded to components that do not lead themselves to hot dip galvanizing must be thoroughly cleaned and cold zinc galvanized to similar coat thickness. Surface preparation for cold galvanizing must meet specifications of the manufacturer of the cold galvanizing product. Product must meet two thousand (2000) hours resistance test to salt spray (ASTM B-117).

2.18 Grout

- .1 Non-shrink grout: conform to Section 03300.

2.19 Balancing Piping Systems

- .1 Balance the Foul Air Piping system in accordance with Section 15045. This includes all of the FOA piping from each tank/channel and the three (3) foul air blowers.

2.20 Concrete

- .1 Provide concrete for concrete surround placed around buried pipe, and fill placed over buried pipe, in accordance with Section 03300 and as shown.

PART 3 EXECUTION

3.1 Preparation

- .1 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.
- .2 Make all minor modifications to suit installed equipment and structural element locations and elevations.

- .3 Piping arrangements indicated on the drawings have been established on the basis of the "Design Standard" listed in the specific process equipment sections. If the equipment to be provided is not the Design Standard, at no additional expense to the Owner, modify the piping arrangement as necessary.
- .4 Advise the Engineer of all modifications. Do not commence work on the related piping until all modifications have been reviewed by the Engineer.
- .5 Include any piping modifications in the shop drawings submitted prior to fabrication or installation.

3.2 Pipe Handling

- .1 Inspect each pipe and fitting prior to installation. Do not install damaged pipe or pipe with damaged protective coatings. Do not use sections of large diameter, thin walled stainless steel piping that may have been deformed out of roundness or dimpled. Such damaged sections must be discarded.
- .2 Remove all foreign matter from inside of pipe prior to installation.
- .3 Repair pipe with damaged protective coatings with material similar to the original in accordance with the manufacturer's directions and to the satisfaction of the Engineer.
- .4 Damaged glass lining cannot be repaired. Damaged pipe must be replaced.
- .5 Use proper implements, tools, and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe or coatings.
- .6 When lifting sections of large diameter, thin wall piping onto the supports use methods that will prevent damage or deformation. Lift evenly at several places to ensure that the piping deflection between lifting points does not exceed 6.3 mm.

3.3 Sleeves

- .1 Unless otherwise noted or approved by the Engineer, provide sleeves where piping passes through a wall, floor or ceiling.
- .2 Locate and place sleeves prior to construction of cast-in-place elements and prior to the construction of concrete and masonry building elements.

3.4 Installation of Pipe Underground/Buried and Below Structures

- .1 Trenching and backfill for buried pipe: conform to Division 2.
- .2 Pipe laying and bedding: conform to Division 2.
- .3 Unless otherwise shown, protect pipe laid below structures with a concrete surround having a minimum coverage of 100 mm all around the pipe; extend concrete surround to undisturbed ground.
- .4 For concrete surround, comply with the following:

- .1 Install pipe in straight alignment. Do not exceed 10mm variance from the true alignment in any direction.
- .2 Ensure the pipe alignment stays true during and after placement of concrete surround.
- .3 Ensure that the method used to prevent pipe uplift during placement of concrete surround results in a level invert and crown.
- .4 Maintain pipe circular cross section
- .5 Provide lean concrete to within 150 mm of the underside of the slab or footing for backfill over pipe laid below structures, except as detailed otherwise.
- .6 Place concrete in accordance with Division 3.
- .7 Provide yellow jacket or tape wrap on all fittings and flanged, grooved, plain end and welded joints underground and below structures.
- .8 Unless otherwise specified or shown, for underground piping provide groove joints or flex coupled joints at 6 m on centre.
- .9 Use anti-seize compound with all stainless steel nuts and bolts.
- .10 Prior to installation provide a manufacturer's representative, from the HDPE pipe manufacturer, for a minimum of one (1) day to instruct personnel on installation procedures of HDPE pipe.

3.5 Installation

- .1 Fabricate and install process and pressure piping in accordance with the Process Piping Code B31.3 and the Local Boiler and Pressure Vessels Act and Regulations. Fabricate and install domestic hot and cold water piping, sanitary piping and storm drainage piping in accordance with the Local Plumbing Code.
- .2 Make adequate provision in piping and pipe support systems for expansion, contraction, slope, and anchorage. Supports, bracing, and expansion joints shown in the drawings are schematic only. The Contractor is responsible for the design, supply, and installation of the piping system in general accordance with the indicated requirements.
- .3 Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag or stress.
- .4 Install expansion joints where shown and at other locations as necessary to allow for piping expansion and contraction.
- .5 Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves or pipe.
- .6 Accurately cut all piping for fabrication to field measurements. Process air piping sections must be measured and cut at 15 to 20°C. If the installation in the field takes place at lower outdoor temperatures, provide circulation of hot air inside the piping to expand the material such that flanges can be bolted. Expansion

joints for process air piping must be blocked at their natural length at 15 to 20°C and such that they will not deflect excessively during handling and installation. These blocks must be removed prior to pressure testing.

- .7 Install pipes in straight alignment. For large diameter (500 ND and greater), thin walled (6.4 mm and less) stainless steel piping provide laser alignment of all pipe supports. Lateral and vertical misalignment between any three (3) consecutive supports must not exceed the pipe wall thickness.
- .8 For piping other than large diameter, thin walled stainless steel, do not exceed 10 mm in 10 m variance from the true alignment, in any direction.
- .9 Fabricate and assemble pipe runs so that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment is not permitted. Undo and subsequently remake all pipework connections to ensure that springing does not occur. Take care not to damage equipment, valves or flanges.
- .10 Slope instrument air piping to condensate traps. Provide condensate traps as recommended by the manufacturer of the instrument air compressor.
- .11 Do not cut or weaken the building structure to facilitate installation.
- .12 In parallel pipe runs, offset flanges and/or grooved joint fittings by a minimum of 200 mm.
- .13 In vertical pipe runs of diameter greater than 250 mm, provide 200 mm long spool piece on lower side of each valve.
- .14 Provide aluminum watertight drip trays under pipe carrying corrosive commodities crossing over cable trays. The drip trays will be 300 mm wider and 600 mm longer than the piping area over the cable tray. Fit with 12 mm drains that extend to within 150 mm of the floor, near a floor drain.
- .15 Refer to structural drawings for support, guide and anchor details. Where an FRP band is called for on either side of a support, guide or anchor, provide the FRP of sufficient size for a 110 kN force.

3.6 Mild Steel Welding

- .1 Use manual shielded metallic arc (SMAW), submerged arc (SAW), or inert gas shield arc (GMAW) or gas tungsten arc (GTAW) welding.
- .2 Welding procedures must conform to CSA Z183.
- .3 Bevel plain pipe ends prior to welding.
- .4 Clean and dry welding surfaces thoroughly prior to welding, in an area not less than 0.3 m wide on each side around the welding line.

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- .5 Do not proceed with welding when metal temperatures fall below minus 18° Celsius. Apply supplemental heat when metal temperatures are below 0° Celsius, to heat the metal to 20° Celsius.
 - .6 Maintain flanges, pipes, fittings, etc. in alignment during welding. Ensure that no part of the weld is offset by more than twenty (20%) percent of the pipe wall thickness.
 - .7 Make tack welds of material equal to the root pass. Tack welds which have not cracked may be incorporated in the root pass.
 - .8 Ensure the first bead obtains full root penetration with a minimum of weld material projecting within the pipe.
 - .9 For butt welds of pipe diameters less than 200 mm use a minimum of two (2) passes. For larger pipe use three passes - minimum.
 - .10 For lap joints, weld joint in two (2) passes minimum.
 - .11 Between passes, visually inspect bead for pinholes or other defects. Repair any defects prior to the placement of the next pass.
 - .12 Clean all flux, slag and other foreign material from the weld prior to applying a successive bead, and on completion of the weld.
 - .13 Do not start successive passes at the same point.
 - .14 Completely fill the joint with weld, and have a reinforcement greater than 1.5 mm and less than 3.0 mm, with no undercutting at the weld edges.
 - .15 Provide a smooth surface for coating application to exterior surfaces of pipe. Grind or buff all welds to a minimum radius of 6 mm on all edges and corners. Adhere to latest edition of NACE RP0178. Refer to Section 40 05 30.
 - .16 Contractor to provide access to all external welds in fabricated spool pieces for grinding purposes. This will ensure that the coating application on welds can be properly ground to achieve proper coating application. Provide maximum of 400 mm distance from any weld.
 - .17 Repair linings and coatings after welding.

3.7 Stainless Steel Welding

- .1 Conform to reviewed stainless steel pipe welding procedures, which have been stamped and signed by a professional engineer registered with NAPEG (Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists).
- .2 Remove all scale, rust and any other surface deposits from the entire pipe and fittings before welding. Be particularly thorough with the internal surface preparation.

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- .3 For all stainless steel pipe intended to convey liquids, use inert gas backing (GMAW or GTAW) for field and shop welds. For these services, solar flux will not be allowed.
 - .4 Ensure the first bead obtains full root penetration with a minimum of weld material projecting within the pipe.
 - .5 Grind or buff all welds to a minimum radius of 6mm on all edges and corners to achieve a smooth surface, eliminate any pockets and eliminate any protruding root passes. Adhere to latest edition of NACE RP0178. If material thickness will not allow 6mm radius, make radius one half of material thickness.
 - .6 Ensure the OD weld (weld cap) is free of excessive weld cap and free of discoloration due to welding. Ensure all ID welds (root pass) or OD welds exposed to wastewater or corrosive fluids/environments are ground flush and have no discoloration.
 - .7 Passivation
 - .1 Passivate the inside of all stainless steel piping after completion of all piping and supports welding. Any welding after passivation will require passivation of the entire piping section again. A piping section is the length between flanges.
 - .2 Comply with ASTM A380, Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems, and ASTM A967, Standard Specification for Chemical Passivation Treatment for Stainless Steel Parts, latest edition.
 - .3 Use fine grit carbide sandpaper to remove any discoloration, such as bluish due to overheating.
 - .4 Thoroughly clean the interior of the pipe and ensure there are no oil or grease deposits or particulate (such as from the sandpaper) using trisodium phosphate (TSP) solution per manufacturer's recommendation. Thoroughly rinse with tap water.
 - .5 Acid pickle using a solution of twenty (20%) percent nitric acid and two (2%) percent hydrofluoric acid in chloride-free water. Treat for no less than two (2) hours at 20°C to 40°C. Do not do the work at less than 20°C. An equivalent pickling paste must be used for air piping not designed to be filled with water. Follow the manufacturer's instructions. Rinse thoroughly with chloride-free water (distilled or de-ionized) until the rinse water shows less than 0.1 mg/L of fluoride. Rinse thoroughly with chloride-free water (distilled or de-ionized) brought to pH 10 using ammonia (preferred). Alternatively caustic soda or soda ash may be used to increase the final rinse water pH, but the maximum concentration of chloride allowed in this solution is 1 mg/L. Note that chloride concentration in commercially available caustic soda and soda ash may be too high for this use. Completely drain and leave drying in warm air (not less than 20°C at the outlet end) overnight.

- .6 Collect all acids, caustics and rinses and take all necessary precautions to prevent spills on the ground. Neutralize as needed, for example blending acid and caustic wastes and using pebble or ground limestone, lime or other suitable material. Dispose of the neutralized waste as indicated by the Owner at the closest primary effluent channel. Note that the Owner may limit the volume that may be discharged over any period of time. Take measures to prevent freezing.
- .7 Process air piping may not be filled with water unless laid flat on the ground or otherwise supported every 5 m and on each side of sliding supports.
- .8 Pickling and passivating may require the ingress of an individual into the process air pipe. A single individual may do so once the pipe has been installed. Provide adequate ventilation that will blow any fumes away from the worker. This individual must wear adequate protection per MSDS and clean, thick cloth socks over footwear. Confined entry procedures must apply. Footwear, other items or tools that could scratch the stainless steel surface must not be carried into the pipe.

3.8 Grooved Piping System – Installation

- .1 All grooved products must be installed according to manufacturer's installation instructions.
- .2 Carbon steel pipe may be either Cut Grooved or Roll Grooved as appropriate for pipe and service specified.
- .3 Schedule 5 and 10 stainless steel pipe must be roll grooved using "RX" rolls in accordance with manufacturer's installation instructions.
- .4 Ductile iron pipe must utilize "Radius Cut Grooves". Grooves must conform to either "Rigid" or "Flexible" cut groove dimensions as specified for application. Pipe must have wall thickness of Class 53 pipe or greater.
- .5 Copper piping must be Roll Grooved in accordance with manufacturer's installation instructions.

3.9 Testing

- .1 Give the Engineer twenty-four (24) hours notice prior to testing.
- .2 Do not insulate or conceal work until piping systems are tested and accepted.
- .3 Complete any required weld tests.
- .4 Interior of stainless steel piping must be bright metal with no discoloration. Any discoloration, such as bluish tint at welds, will require spot pickling and passivation using paste containing nitric acid and hydrofluoric acid, followed by rinsing and drying as indicated previously.
- .5 Spot check the interior of the stainless steel piping and weld areas as indicated by the Engineer. Use five (5%) percent copper sulphate solution. After ten

(10) minutes at not less than 15°C there must be no observable deposit of metallic copper. Otherwise, pickling and passivation must be repeated for the entire piping section. Carefully wipe off copper sulphate solution with several damp pieces of cloth.

- .6 Supply all water, air and inert gases required for pressure testing.
- .7 Supply all pumps, compressors, gauges, etc. required for testing.
- .8 Install air threadolets, air relief valves and line fitting valves as necessary to complete testing. Remove after testing and plug the threadolets.
- .9 Cap or plug all lines which are normally open ended. Remove on completion of testing.
- .10 Provide all temporary thrust restraints necessary for testing. Remove upon completion of testing.
- .11 Test all underground lines prior to backfilling. Do not place concrete surround until lines are tested.
- .12 Test all existing piping where it connects to new piping to the first valve in the existing piping. Repair any failures in existing piping which occur as a result of the test after informing the Engineer of such failure.
- .13 Isolate all low pressure equipment and appurtenances during testing so as not to place any excess pressure on the operating equipment.
- .14 Where defective material or equipment is identified, repair or replace using new material.
- .15 Release pressure safely, flush and drain liquid pipes after pressure tests. Release pressure safely and purge if needed all gas pipes after pressure tests.
- .16 Flush and drain liquid pipes after pressure tests. Purge all gas pipes after pressure tests.
- .17 Dispose of flushing water in manner approved by the Engineer, which causes no damage to buildings or siteworks.

3.10 Pressure Testing of Liquid Lines

- .1 Hydrostatically test all lines normally used for the conveyance of liquid using water as the test medium.
- .2 Test pressures and durations must be as specified in the detailed specification sheets.
- .3 Ensure all lines are filled with water. Bleed air from all high spots using the taps provided specifically for that purpose.

- .4 Zero leakage is permitted throughout the specified test period for all exposed piping, buried insulated piping, and any liquid chemical lines.
- .5 Show evidence of leakage rates below 0.01 litre per hour per mm pipe diameter per 100 m of pipe length for buried piping, unless otherwise specified.
- .6 Test drains in accordance with the Local Plumbing Code.

3.11 Pressure Testing of Gas, Air and Vapour Lines

- .1 Hydrostatically or pneumatically pressure test, as shown in the table below, all lines normally used for the conveyance of gas, air, and/or vapour in accordance with Process Piping Code B31.3 procedures for testing pressure piping (and CAN/CGA B149.6 for buried digester gas piping – not applicable for this project). Pneumatically test all instrument air lines in accordance with ISA-RP7.1.
- .2 For gas and air lines to be hydrostatically tested, check support system to ensure it is capable of withstanding loads imparted by test method. Provide any additional supports necessary in a manner acceptable to the Engineer. At the Engineer's request, provide calculations indicating design of temporary support system.
- .3 Other than for chlorine and sulphur dioxide piping systems, use the following test medium:

Pipe Size Specified	Testing Medium	Test Pressure
50 mm and smaller	500 kPa or less	Air or Water
50 mm and smaller	Greater than 500 kPa	Water
Greater than 50mm	500 kPa or less	Air or Water
Greater than 50 mm	Greater than 500 kPa	Water

- .4 Test pressures are identified in the detailed piping specification sheets.
- .5 Zero leakage rate for insulated systems, and systems tested with water is required at the specified test pressure through the test period. Prior to commencing test using air, ensure air will be at ambient temperature and specified test pressure.
- .6 Do not exceed five (5%) percent of the specified test pressure as the allowable leakage rate over the test period for other systems tested with air. Provide feed air pressure regulator with gauge and pressure safety valve with ring pressure set at not more than 20 kPag above the test pressure and adequately sized for both the compressor capacity and any condition that could result in pressure increases.
- .7 Wet all joints using a mixture of soap and water in systems tested with air. Remake all joints which display leakage and retest. For stainless steel piping, repeat cleaning and passivation procedure indicated above for the entire piping section, then test for adequate passivation in the re-worked area.
- .8 Test natural gas piping in accordance with CAN/CGA B139-1.

3.12 Cleaning and Flushing

- .1 After installation and prior to testing, perform initial cleaning of process and utility lines. Clean piping greater than 150 mm and less than 600 mm by passing a tightly fitting cleaning ball or swab through the pipeline, unless specified otherwise. Lines greater than 600 mm may be cleaned manually or with a cleaning ball or swab. Give lines smaller or equal to 150 mm an initial flush or purge.
- .2 Unless specified otherwise, flush liquid systems after testing, with clean water and screens in place. Maintain flushing for a minimum period of fifteen (15) minutes and until no debris is collected in the screens.
- .3 Remove the screens and make the final connections after the screens have remained clean for a minimum of twenty-four (24) consecutive hours of operation. Screens in solids handling systems are exempt; remove prior to placing the system in service.
- .4 In air or gas systems with pipe sizes less than or equal to 150 mm, purge with air and/or inert gases before testing. Upon completion of testing and cleaning, drain and dry the piping with a dry air stream. Satisfy ANSI/ISA-S7.3 standards for instrument air systems.
- .5 Brush clean steel pipe exterior to SSPC-P3 standard prior to painting. Also refer to Section 40 05 30.

3.13 Disinfection

- .1 Disinfect lines intended for potable water service after testing in accordance with AWWA C651.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 The piping specification sheets on the following pages detail the requirements for each type of process pipe included in the work.
- .2 The piping materials are listed on the specification sheets Submittals

PART 2 PRODUCTS

2.1 Process Piping Commodity Summary

Abbreviation	Process	Pipe Material
DWS	Dewatered Sludge	SS6
DR	Drainage (Process Waste)	MS3
DSUB	DAF Subnatant	MS3
FE	Final Effluent	MS3
FIL	Filtrate	MS3
FOA	Foul Air	FRP1
IA	Instrument Air	SS6
ML	Mixed Liquor	MS3
PA	Process Air	SS2
PE	Primary Effluent	MS3
PLY	Polymer Solution	PVC3
RAS	Return Activated Sludge	MS3
RS	Raw Sewage	MS3
SE	Secondary Effluent	MS3
SRS	Screened Raw Sewage	MS3
DPS	Dewatered Primary Sludge	DI2
TWAS	Thickened Waste Activated Sludge	DI2
UTA	Utility Air	Mild Steel (Sch. 40), Copper (Type K hard)
VA	Ventilation Air	Aluminum and PVC
WAS	Waste Activated Sludge	DI2
NPW	Non-potable Water	MS1

2.2 Schedule

Detailed pipe specifications for different commodities follow.

PIPE SPECIFICATION DATASHEET – DI2

COMMODITY CODE	PIPE SIZE (mm)	EXPOSURE	OPERATING PRESSURE (kPa)	TEST PRESS. (kPa)	
DR	≥75	WWTP Building	Atmos.	130	
DPS	50-300	WWTP Building	Atmos.	130	
TWAS	100-300	WWTP Building	Atmos. / 50	130	
WAS	100 - 300	WWTP Building			
PIPE					
LOCATION	SIZE (mm)	MATERIAL	RATING	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Buried, Below Structures Exterior, Submerged	75 – 750	Ductile Iron	Class 53	AWWA C151/A21.15	Note 1
COATINGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
WWTP Building	75 – 750	Paint	Field	Refer to Section 40 05 30	
Buried,	75 – 750	Concrete Surround	Field	Refer to Division 3 Cast-in-Place Concrete	
Below Structures, Exterior, Submerged	75 – 750	Epoxy	Field	AWWA C210	
LININGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
WWTP Building Buried, Below Structures, Exterior Submerged	75 – 750	Glass Lining	Factory		
JOINTS					
LOCATION	SIZE (mm)	TYPE	SPACING	MATERIAL SPECIFICATION	REMARKS
WWTP Building	75 – 750	Grooved Joint	6 m	AWWA C606	Note 4
Buried, Below Structures	75 – 750	Groove Jt. or Bell/spigot	6 m	AWWA C606/C110	Note 4
Exterior, Submerged	75 – 750	Grooved Joint	6 m	AWWA C606	Note 4
EQUIPMENT CONNECTIONS					
EQUIPMENT END	SIZE (mm)	PIPE END	RATING	SPECIFICATION	REMARKS
Cast Iron, Flanged	75 – 750	Flange/grooved adapter or Victaulic flange	CI 125, FF	ANSI B16.1 AWWA C606	
Steel, Flanged	75 – 750	Flange/grooved adapter or Victaulic flange	CI 150, FF	ANSI B16.5 AWWA C606	

FITTINGS AND APPURTENANCES					
ITEM	SIZE (mm)	MATERIAL	RATING	SPECIFICATION	REMARKS
Ell – Short Radius Ell – Long Radius Tees, Reducers Reducing Outlets, Y	75 – 750	Ductile Iron	Class 125	ASTM A606	ANSI B16.3
Plug	75 – 750	Ductile Iron	Class 125		
Flange Adaptors	75 – 750	Mild Steel	Class 125	ASTM A53 ANSI B16.1 ASTM A181/A181M	
Bolts			Hex. Head	ASTM A307 Gr. A	
Nuts			Hex. Head	ASTM A563M Gr. A	
Flange Gaskets	75 – 750	BI Neoprene	1.6mm thick		
Groove Joint Gaskets	75 – 750			AWWA C606	Note 3
INSPECTION AND TESTING					
Hydrostatic test with clean water.					
CLEANING AND CONDITIONING					
Remove debris and flush with water at minimum velocity of 1.0 m/s.					
NOTES					
- Where noted on the drawings use high strength pipe (DI3) - Finish fittings in the same manner as the pipe. - Comply with manufacturer's recommendations for grooved joint gaskets. - Provide joints at noted spacing for pipe disassembly or as per lengths provided, nominal 6m spacing.					

COMMODITY CODE	PIPE SIZE (mm)	EXPOSURE	OPERATING PRESSURE (kPa)	TEST PRESS. (kPa)	
PW	20 – 350	WWTP Building	650	1000	
NPW	20 – 350	WWTP Building	650	1000	
PIPE					
LOCATION	SIZE (mm)	MATERIAL	RATING	MATERIAL SPECIFICATION	REMARKS
WWTP Building	75-600	Mild Steel, CW, ERW or Seamless	Sch. 40	ASTM A53/A53M, Gr. B	
WWTP Building	<75	Mild Steel, CW, ERW or Seamless	Sch. 80	ASTM A53, Gr. B	
COATINGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
WWTP Building	<75	Insulation and recovering	Field		Note 1
	75 – 600	Insulation and recovering	Field		Note 1
LININGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
WWTP Building	100 – 350	Epoxy	Factory	AWWA C210, NSF 61	Note 9, 12
JOINTS					
LOCATION	SIZE (mm)	TYPE	SPACING	MATERIAL SPECIFICATION	REMARKS
WWTP Building	<75	Threaded couplings, malleable iron	N/A	ASTM A197/A197M ANSI B16.3, CI 150	
	<75	Unions, malleable iron	12 m		
	75 – 600	Butt Weld	N/A		
	75 – 600	Grooved Joints		AWWA C606	Note 13
	75 – 600	Flanges	18 m	ANSI B16.5	Note 15
EQUIPMENT CONNECTIONS					
EQUIPMENT END	SIZE (mm)	PIPE END	RATING	SPECIFICATION	REMARKS
Cast Iron Flange	150 – 600	Steel Flange	CI 125, FF	ANSI B16.1	
Steel Flange	150 – 600	Steel Flange	CI 150, RF	ANSI B16.5	
Steel, Plain End	150 – 600	Flexible Joint, Flanged one end	CI 150	Flange – ANSI B16.5	

FITTINGS AND APPURTENANCES					
ITEM	SIZE (mm)	MATERIAL	RATING	SPECIFICATION	REMARKS
Flanges, FF or RF	75 – 600	Mild Steel	Class 150	Material: ASTM A234/A234M, WPB Dimensions: ANSI B16.5	
Ell – Short Radius Ell – Long Radius	60 – 75	Malleable Iron, Banded	Class 150	Material: ASTM A197/A197M Dimensions: ANSI B16.3	Note 6
Tees, Reducers, Reducing Outlets, Laterals and Caps	75 – 600	Mild Steel, Seamless	Same as Pipe	Material: ASTM A234/A234M, WPB Dimensions: ANSI B16.5, ANSI B16.9	
3-Piece Ell	350 – 600	Mild Steel, ERW or Seamless	Same as Pipe	Material: Same as Pipe Dimensions: AWWA C208	
Plug	>60	Mild Steel	Class 150, Blind Flange	Material: ASTM A181/A181M Dimensions: ANSI B16.5	
Nuts, Submerged or Below Ground	>60		Heavy Hex.	ASTM A194/A194M Gr. 8	
Bolts, Submerged or Below Ground			Hex. Head	ASTM A193/A193M, Gr. B8, Cl.1	
Flanged Adaptors	75 – 600	Same as Pipe	Same as Pipe	Flange: ANSI B16.5	Note 10
Flanged Gaskets	150 – 250	Neoprene	1.6 mm thick		Note 4, 11
Flanged Gaskets	>300	Neoprene	3.2 mm thick		Note 4, 11
Vic. Gaskets	150 – 600			AWWA C606	Note 5, 10
Grooved Pipe Couplings	75 - 600	Ductile iron		AWWA C606, Victaulic style 107 rigid coupling or style 177 flexible coupling	Note 14
Grooved end fittings	75 - 600	Ductile iron	Same as pipe and couplings	ASTM A536, Victaulic	Note 12
INSPECTION AND TESTING Refer to Section 15050 Piping Systems for other requirements. ASME B31.3 for steam piping. Visual and random nondestructive testing for welds.					
CLEANING AND CONDITIONING Remove debris and flush with water at a minimum velocity of 1.0 m/s.					
NOTES 1. See Section 15261 Thermal Insulation for Pipes and Equipment. 2. Tape wrap butt welded joints after welding. Plain end or grooved joints and valves shall be protected with a polyethylene sheath or a shrink sleeve attached to the pipe with tape wrap. 3. Finish fittings, etc. in same manner as pipe. 4. Provide full faced gaskets for flat face flanges and ring gaskets for raised face flanges. 5. Comply with manufacturer's recommendations for grooved joint gaskets. Use end seal type gaskets on epoxy lined pipe. NSF 61 approval required for potable water service. 6. Provide beveled edges for all welded fittings. 7. Underground joints at 6.0 m on center or as shown on the drawings shall be groove jointed or flex coupled. 8. Field touch up linings and coatings after welding. 9. Epoxy lining not required for the following services: HWS, HWR, GLSS, GLSR. 10. Not applicable to engine exhaust service (EEX). 11. For engine exhaust, use high temperature non-asbestos fibre gaskets, 500 deg C minimum. 12. Linings for potable water service shall meet the requirements of NSF 61. 13. Use rigid couplings except where flexible coupling is specifically indicated.					

PIPE SPECIFICATION DATASHEET – MS3

COMMODITY CODE	PIPE SIZE (mm)	EXPOSURE		OPERATING PRESSURE (kPa)	TEST PRESS. (kPa)
DR	25 – 350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos.	150
RS	50 - 350	WWTP Building, Exterior, Buried, Submerged, Below Structures		130	200
DSUB	50 - 350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos. / 100	150
FE	50-350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos.	150
FIL	50-350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos.	150
ML	50-350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos.	150
PE	50-350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos.	150
SE	50-350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos.	150
SRS	50-350	WWTP Building, Exterior, Buried, Submerged, Below Structures		Atmos.	150
PIPE					
LOCATION	SIZE (mm)	MATERIAL	RATING	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Buried, Below Structure, Exterior Submerged	65 –	Mild Steel, CW or ERW	Standard wt.	ASTM A53/A53M	
	65 – 150	Mild Steel, CW or ERW	Standard wt.	ASTM A53/A53M	
	65 – 150	Mild Steel, CW or ERW	Standard wt.	ASTM A53/A53M	
COATINGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Buried, Below Structure, Exterior Submerged	65 - 1050	Yellow Jacket or Tape wrap	Factory	Section 15050 Piping Systems	Refer to Section 40 05 30
	65 – 1050				
	65 – 1050	Epoxy	Factory	AWWA C210	
LININGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Buried, Below Structure, Exterior Submerged	65 – 1050	Epoxy	Factory	AWWA C210	Note 8
	65 – 1050	Epoxy	Factory	AWWA C210	
	65 – 1050	Epoxy	Factory	AWWA C210	
JOINTS					
LOCATION	SIZE (mm)	TYPE	SPACING	MATERIAL SPECIFICATION	REMARKS
Tunnels, Buildings	60-1050	Butt Welded	N/A	ANSI B16.9	Note 8
		Grooved	18 m	AWWA C606	
		Flexible Couplings	As Shown		
		Flanged	N/A	ANSI B16.5	

FITTINGS AND APPURTENANCES					
ITEM	SIZE (mm)	MATERIAL	RATING	SPECIFICATION	REMARKS
Steel Flange	60 – 1050	Steel Flange	CI 150, FF	ANSI B16.5	
Steel, Plain End	60 – 1050	Flexible Joint	CI 150	ANSI B16.5	
Flanges, FF or RF	60 – 1050	Mild Steel	Class 150	ASTM A234/A234M, WPB ANSI B16.5	Note 4
EII – Short Radius EII – Long Radius Tees, Reducers, Reducing Outlets, Y	60 – 1050	Mild Steel, Seamless	Same as Pipe	Material: ASTM A234/A234M, WPB Dimensions: ANSI B16.5	Note 4
Plug	60 – 1050	Mild Steel Blind Flange	Class 150	Material: ASTM A181/A181M, Gr. 1 Dimensions: ANSI B16.5	
Flanged Adapters Grooved Joint to Flange	60 – 1050	Same as Pipe	Same as Pipe	Flange – ANSI B16.5	
Bolts, Submerged or Below Ground			Hex. Head	ASTM A193/A193M, Gr. B8, CI 1	
Nuts, Submerged or Below Ground	<25 mm >25 mm		Hex. Heavy Hex.	ASTM A194/A194M, Gr. 8	
Flange Gaskets	60 – 300	Bl. Neoprene	1.6 mm thick		Note 2
Flange Gaskets	>300	Bl. Neoprene	3.2 mm thick		Note 2
Grooved Joint Gaskets	60 – 1050			AWWA C606	Note 3
INSPECTION AND TESTING					
Test sample lines at 1000 kPa (operating pressure of 400-600 kPa)					
CLEANING AND CONDITIONING					
Remove debris and flush with water at minimum velocity of 1.0 m/s.					
NOTES					
1. Finish valves, fittings, etc., in same manner as pipe. 2. Provide full-faced gaskets for flat face flanges and ring gaskets for raised face flanges. 3. Comply with manufacturer's recommendations for grooved joint gaskets. 4. Provide beveled edges for all welded fittings and connections. 5. Field touch-up linings and coatings after welding. Do not weld piping where access for touch-ups is restricted. 6. Slip-on flanges shall be provided except where noted otherwise herein or in the drawings. Provide weldneck flanges (mild steel pipe) on each side of fittings and wafer body valves. 7. Brush clean steel pipe to SSPC-P3 standard prior to painting. 8. The drawings indicate coupling, flanges, or other joints that may be disassembled at a minimum number of locations. In addition, provide joints noted in these specification sheets at the specified maximum spacing to allow for pipe disassembly through the remainder of the pipe runs. Contractor is to locate.					

PIPE SPECIFICATION DATASHEET – PVC3

COMMODITY CODE	PIPE SIZE (mm)	EXPOSURE	OPERATING PRESS./TEMP. (kPa) / (C)	TEST PRESS. (kPa)	
PLY	10 – 65	WWTP Building, Exterior, Submerged	100	150	
PIPE					
LOCATION	SIZE (mm)	MATERIAL	RATING	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Submerged, Exterior	10 – 65	PVC	Schedule 80	CAS 137.3 ASTM D1785 ASTM D1784	
COATINGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
LININGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
JOINTS					
LOCATION	SIZE (mm)	TYPE	SPACING	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Submerged, Exterior	10 – 65	Solvent Weld w/unions unions	N/A 12 m	ASTM D2467, D2564	Note 1
FITTINGS AND APPURTENANCES					
ITEM	SIZE (mm)	MATERIAL	RATING	SPECIFICATION	REMARKS
Couplings EII – Short Radius EII – Long Radius Tees, Reducers, Reducing Outlets, Y	10 - 65	PVC	Sch. 80	ASTM D2467	
Bolts		Stainless steel	Hex. Head	ASTM A193 Gr. B Cl. 1	
Nuts		Stainless steel	Hex. Head	ASTM A194 Gr. B	
PVC Solvent				ASTM D2564	
INSPECTION AND TESTING					
CLEANING AND CONDITIONING					
Remove debris and flush with water at minimum velocity of 1.0 m/s.					
NOTES					
1. The drawings may indicate coupling, flanges, or other joints that may be disassembled at a minimum number of locations. In addition, provide joints noted in these specification sheets at the specified maximum spacing to allow for pipe disassembly through the remainder of the pipe runs. Contractor is to locate.					

PIPE SPECIFICATION DATASHEET – SS2

COMMODITY CODE	PIPE SIZE (mm)	EXPOSURE		OPERATING PRESS./TEMP. (kPa) / (C)	TEST PRESS. (kPa)
PA	75 – 1200	Pumphouses, Tunnels, Exterior, Submerged		75	150
PIPE					
LOCATION	SIZE (mm)	MATERIAL	RATING	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Exterior, Underground, Submerged	75	304L Stainless Steel	11 Gauge	Material: ASTM A240 Fabrication: ASTM A778	
	100 – 200	304L Stainless Steel	14 Gauge		
	250 – 300	304L Stainless Steel	12 Gauge		
	350 – 450	304L Stainless Steel	11 Gauge		
	500 – 600	304L Stainless Steel	10 Gauge		
	650 – 1200	304L Stainless Steel	4.7 mm		
COATINGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
LININGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
JOINTS					
LOCATION	SIZE (mm)	TYPE	SPACING	MATERIAL SPECIFICATION	REMARKS
WWTP Building, Exterior, Underground, Submerged	>75	Butt Welded Van Stone Flange	N/A 24 m	ANSI B16.5 ASTM A312	Note 3
Exterior, Submerged	>75	Butt Welded	N/A	ANSI B16.9	
Exterior, Submerged	>75	Van Stone Angle Ring, Backing Flanges	18 m and 500 mm above liquid level		Note 3
EQUIPMENT CONNECTIONS					
EQUIPMENT END	SIZE (mm)	PIPE END	RATING	SPECIFICATION	REMARKS
Cast Iron, Flanged	75 – 1200	Rolled Angle, Van Stone, Backing Flange	CI 125 FF	ANSI B16.1 ASTM A774	
Steel, Flanged	75 – 1200	Rolled Angle, Van Stone, Backing Flange	CI 150, RF	ANSI B16.5 ASTM A774	
Steel Plain End	75 – 1200	Flange Adaptor and Van Stone, Backing Flange	CI 125	ASTM A774 ANSI B16.5	

PIPE SPECIFICATION DATASHEET – SS2

FITTINGS AND APPURTENANCES					
ITEM	SIZE (mm)	MATERIAL	RATING	SPECIFICATION	REMARKS
Van Stone Flanges, Rolled Angle FF or RF	75 – 1200	304L St. Steel 304L SS Steel Backing Flange	Cl 125	Flanges: ASTM A774 Pattern: ANSI B16.1	Note 1
Ell – Short Radius Ell – Long Radius Tees, Reducers Reducing Outlets, Y	75 – 1200	304L Stainless Steel, Single Longitudinal Weld Seam	Same as Pipe	General: MSS SP43 Material: ASTM A774 Dimensions: ANSI B16.1	Note 2
3-Piece Ell	350 – 550	304L Stainless Steel, Single Longitudinal Weld Seam	Same as Pipe	Material: ASTM A778 Dimensions: ANSI B16.1	
5-Piece Ell	600 – 1200	304L Stainless Steel	Same as Pipe	Material: ASTM A778 Dimensions: ANSI B16.1	
Cap	75 – 1200	304L Stainless Steel	Same as Pipe	Material: ASTM A778 Dimensions: ANSI B16.1	
Expansion Couplings	75 – 1200	Synthetic Rubber Galvanized Steel Flange	Same As Pipe		
Bolts		Stainless Steel	Hex. Head	ASTM A193 Gr. B8, Cl 1	
Nuts	≥ 25 mm >25 mm	Stainless Steel	Hex. Heavy Hex.	ASTM A194 Gr. 8	
Flange Gaskets	75 – 250	Reinforced Synthetic Fibre-Nitrile Binder	1.6 mm thick		
Flange Gaskets	>300	Reinforced Synthetic Fibre-Nitrile Binder	3.2 mm thick		
INSPECTION AND TESTING Pneumatic at 150 kPag for 24 hour period. Visual and random nondestructive testing for welds.					
CLEANING AND CONDITIONING 1. Remove debris. 2. Passivate all piping after completion of welding.					
NOTES 1. Flanges shall be Van Stone type, with galvanized mild steel backing rings, drilled and faced to Class 150 in accordance with ANSI B16.5. In submerged and exterior locations use stainless steel back-up rings. 2. Provide beveled edges for all welded fittings and connections. 3. The drawings may indicate coupling, flanges, or other joints that may be disassembled at a minimum number of locations. In addition, provide joints noted in these specification sheets at the specified maximum spacing to allow for pipe disassembly through the remainder of the pipe runs. Contractor is to locate. 4. For PA piping, insulation shall be a minimum 50 mm thickness and as required for personnel protection at the design temperature of the pipe ensuring the surface temperature is below 40 deg C. 5. Pipe spools to be shop fabricated. Field welds require approval by Engineer.					

PIPE SPECIFICATION DATASHEET – SS6

COMMODITY CODE	PIPE SIZE (mm)	EXPOSURE		OPERATING PRESSURE (kPa)	TEST PRESS. (kPa)
IA	<80	WWTP Building		760	1140
PIPE					
LOCATION	SIZE (mm)	MATERIAL	RATING	MATERIAL SPECIFICATION	REMARKS
WWTP Building and Submerged	20 – 65	304L Stainless Steel	Sch. 10S	ASTM A312/A312M Type 304 seamless annealed, pickled and passivated.	Note 3
COATINGS					
LOCATION	SIZE (mm)	MATERIAL	FACTORY/ FIELD	MATERIAL SPECIFICATION	REMARKS
Buried					Note 4
JOINTS					
LOCATION	SIZE (mm)	TYPE	SPACING	MATERIAL SPECIFICATION	REMARKS
WWTP Building	20 – 65	Socket welded	N/A		
	20 – 65	couplings			
	20 - 50	VIC-PRESS			Note 5
FITTINGS AND APPURTENANCES					
ITEM	SIZE (mm)	MATERIAL	RATING	SPECIFICATION	REMARKS
Couplings EII – Short Radius EII – Long Radius Tees, Reducers, Thredolets	20 – 65	304L Stainless Steel	CL 2000	Socket Weld: ASTM A182/A182M, Grade F304L, ASME B16.11; annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise.	
	20-50	304L Stainless Steel, EPDM seals	CL 150	VIC-PRESS fitting and joining system	Note 5
Flanges	20 – 65	304L Stainless Steel, Socket Weld	CL 150	Socket Weld Forged: ASTM A182/A182M ANSI B16.5	
Flange Gaskets	20 – 65	Compressed inorganic fibre with Nitrile binder, 1.6mm thick			
Nuts		Stainless Steel	Hex. Heavy Hex.	ASTM A194/A194M Gr. B	
Bolts		Stainless Steel	Hex	ASTM A193/A193M Gr. B8, Cl 1	
INSPECTION AND TESTING					
ASME B31.9					
Visual and random nondestructive testing for welds.					
CLEANING AND CONDITIONING					
Remove debris and flush with water at minimum velocity of 1.0 m/s.					
IA – Purge with dried air for a minimum of 24 hours or until air meets ISA spec.					
NOTES					
1. Provide beveled edges for all welded fittings and connections.					
2. Passivate all welds after completion.					
3. Where threaded connections are required, use schedule 80 pipe.					
4. Provide tape wrap to protect from external corrosion.					
5. Use VIC-PRESS joining system only for instrument (IA) air service.					

Part 1 General

1.1 SECTION INCLUDES

- .1 This Section specifies the supply, installation and testing of valves used for isolation, manual throttling, and bypass.
- .2 All powered actuators and positioners to be sized and provided by valve Manufacturer as per the requirements of Division 25, 26 and 47.
- .3 Refer to the Process and Instrumentation Drawings (P&IDs).

1.2 RELATED SECTIONS

- .1 TBD

1.3 REFERENCE STANDARDS

- .1 TBD

1.4 DEFINITIONS

- .1 Valve Identification: Valves are identified in the Drawings by valve symbols. Refer to the Drawings for lists of valve symbols and labels.
- .2 Actuators: Valves are supplied with their standard operators as detailed in Part 2 unless otherwise noted in Instrumentation Specification Sheets.
- .3 Abbreviations used in Detailed Valve Specification Sheets:
 - ARV - Air Release Valve
 - BF - Butterfly Valve
 - BV - Ball Valve
 - CV - Check Valve
 - GV - Gate Valve
 - GA - Gauge/Root Valve
 - GL - Globe Valve
 - KN - Knife Gate Valve
 - NV - Needle Valve
 - PLV - Plug Valve
 - SV - Solenoid Valve
- .4 Detailed Valve Specification Sheets:
 - .1 Detailed valve specification sheets are provided at the end of this Section for each type of valve which is:
 - .1 Identified in the Drawings with a valve symbol and/or,
 - .2 Described in Part 2 of this specification Section.

- .2 Where there is a conflict between valves described in this Section and other valves described in Division 23 and Division 25, conform to the most stringent requirements.
- .5 Named Acceptable Products are shown to define basic materials and performance criteria required for each valve type. Modify valves as specified to meet the service requirements of the system and detailed specifications.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 A Letter of Compliance, which confirms any variances with the Contract Plans and Specifications, and provides further explanations where necessary to adequately define the scope of supply.
 - .3 Affidavits and registration numbers for each valve type in accordance with specifications.
- .2 Shop Drawings:
 - .1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Catalog cuts and/or shop drawings for each type of valve indicating the valve number, materials of construction, dimensions, head loss characteristics through the valve, operating torque and valve end configuration.
 - .3 An amended Detailed Valve Specification Sheet for all valves. Indicate with check marks where the valve supplied meets the requirements specified and with written amendments where the product differs from the specification.
 - .4 Manufacturers' catalog information, descriptive literature, specifications, and identifications of material of construction.
 - .5 Power and control wiring diagrams, including terminal layout with numbers, panel construction and panel layout drawings, and control schematics diagrams. Control diagrams will also include a description of operation.
 - .6 List of spare parts to be furnished
- .3 Operation and Maintenance Data:
 - .1 Supply maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

-
- .2 Delivery:
 - .1 Deliver materials to the project in original, unopened packages and labeled to clearly identify product name and manufacturer.
 - .2 Items to be shipped as complete assemblies except where partial disassembly is required by transportation regulations or for protection of components.
 - .3 Materials must be packaged to minimize or eliminate the possibility of damage during shipping.
 - .4 Sequence deliveries to avoid delays, but minimize on site storage.
 - .5 Clearly tag valves stating size, type, coatings and mating parts.
 - .3 Storage and Handling:
 - .1 Store and handle in strict compliance with manufacturer's recommendations.
 - .2 All materials to be thoroughly inspected upon receipt and all discrepancies, deficiencies, and/or damages to be immediately reported, in writing, to the supplier.
 - .3 All damages incurred during shipment to be noted on the carrier's Bill of Lading and immediately reported, in writing, to the supplier.
 - .4 All materials to be properly stored on planks or dunnage, out of water and covered to protect from damage from any cause

1.7 QUALITY ASSURANCE

- .1 Contractor responsible for coordination and installation of products provided under this Section.
- .2 The equipment will include all necessary safety devices, such as machinery guards, emergency stops, warning labels, and similar items.
- .3 Provide Canadian Registry Number (CRN) designated by the Territory of Nunavut for each valve type.
- .4 Provide affidavits of compliance, as required by AWWA C500 for gate valves.
- .5 For butterfly valves to be installed below ground, provide affidavits of compliance with AWWA C504.
- .6 Valves are to be marked in accordance with MSS SP-25.

1.8 WARRANTY

- .1 The manufacturer must warrant against any defects in material or workmanship to the belt filter press framework and coating for a period of 12 months from start-up. The warranty must be limited to repairing or replacing with a new component any product or part proving to be defective, at the equipment manufacturer's discretion.

Part 2 Products

2.1 GENERAL

- .1 Provide valves of the same type, size range and service from a single manufacturer.
- .2 Provide new, unused valves for the work.
- .3 Valve materials to be free from defects or flaws, with true alignment and bores.
- .4 Unless otherwise indicated on the P&IDs or specified in Division 25, valves must be the same size as the pipe run in which they are to be installed.
- .5 Clearly mark valve bodies in raised lettering to indicate the valve type, rating, and where applicable, the direction of flow. Conform to MSS SP25.
- .6 Provide padlockable lockout feature on all sizes of the following valve types:
 - .1 Automated Control Valves (electric);
 - .2 Specialty Valves;
 - .3 Manual Isolation and Shut-off Valves;
- .7 Specific requirements for the materials, ratings and service conditions for each valve are listed at the end of this Section.
- .8 Valves to open counter-clockwise.

2.2 DRAWINGS

- .1 The process schematics indicate major process valves required for the process to operate as intended.
- .2 The P&IDs, detailed drawings and process standard drawings indicate process valves plus other valves required for isolation.
- .3 In pipe runs less than 100 mm diameter, in addition to the valves indicated on the P&IDs, detailed drawings and process standard drawings, provide isolation valves in straight pipe runs at intervals no greater than 60 m and at takeoffs to individual services. Provide ball isolation valves in pipe of 65 mm diameter and less, or in pipe of less than 100 mm diameter and carrying solids. Provide butterfly isolation valves in pipe of 75 mm diameter and greater and not carrying solids.
- .4 In pipe runs carrying sludge or scum tap bottom of pipe at low point of runs and install short nipple and isolation valve.
- .5 Provide valves and taps on top of pipe at high point in all liquid pipe runs greater than 60m length where the change in slope exceeds 4 percent.
- .6 Provide flushing connections and valves as shown in standard details, at 30 m intervals on any primary sludge, primary and thickener scum and thickened secondary sludge lines.

- .7 Unless otherwise specified, provide gate valves 400 mm and larger with a bypass valve sized in accordance with AWWA C500.
- .8 Where a valve may be required for the process to function correctly or is required to satisfy fire and safety codes but it is not shown in the Drawings, inform the Engineer and provide details and suggestions for remedial action. Before commencing pipe installation in the related pipe run obtain Engineer's approval.

2.3 VALVE ENDS

- .1 In pipe runs less than 75 mm diameter provide valves with female threaded ends, unless indicated otherwise. Threads to conform to ANSI B1.20.1.
- .2 Valves in pipe runs equal to or greater than 75 mm diameter to be flanged unless indicated otherwise.
- .3 For cast iron body valves, drill flanges to Class 125 pattern conforming to ANSI B16.1. For steel body valves, flanges to be Class 150 pattern or Class 300 pattern conforming to ANSI B16.5 or as noted.
- .4 Do not use grooved joint valve ends.
- .5 Use flanged joints for buried and exterior valves. The flanges are to be compatible with the pipe and jointing technique used.
- .6 Use flanged joints for buried butterfly valves.
- .7 Lug style wafer body butterfly valves must have tapped holes, suitable for the bolt spacing of the pipe flanges placed on either side.
- .8 For gate valves, end flanges must be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1, Class 125 flanges.

2.4 MANUAL OPERATORS

- .1 Provide valves with manual operators unless specifically indicated otherwise on the PEIDs, detailed drawings, process standard drawings, Division 17 or the Instrumentation Specification sheets.
- .2 For hand wheels, clearly show the direction of opening in raised lettering and symbols.
- .3 Hand wheel diameter to conform to the following:

Nominal Valve Diameter (mm)	Minimum Hand Wheel Diameter (mm)
12	50
20	50
25	60
38	75
50	85
65	105
75	200
100	250
150	300
200	350
250	400
300	450
350	450
400	550
450	600
500	600
600	600

- .4 The maximum rim pull on a hand wheel not to exceed 300 N when one side of the valve is at test pressure and the other side is at atmospheric pressure. Where a shaft mounted hand wheel would require greater than this force to operate, provide a gear operator. Unless different operators are scheduled or shown in the Drawings, conform to the following minimum requirements:
- .1 Globe Valves: less than 200 mm, hand wheel; equal to or greater than 200 mm, gear operator.
- .5 Match existing operating nuts. Provide two eight-point operating wrenches.
- .6 Supply stem extensions and valve boxes for buried valves specified in the Drawings, in this Section, and in Clause 2.5 of this Section. Provide two tee type operators.
- .7 Lever operators to conform to the following dimensions:

Nominal Valve Diameter (mm)	Minimum Length of Lever (mm)
6	80
12	80
20	100
38	150
50	150
65	150
75	175
100	225
150	250
200	300
250	450
300	450

- .8 Quarter turn lever operators to be perpendicular to the pipe run when the valve is closed.
- .9 Lever operators on ball valves to be two position. Provide butterfly valves with 10 position latching levers except where used to balance air flows. Where used to balance air flows provide infinite position, screw down levers.
- .10 The maximum pull at the end of the lever arm not to exceed 300 N when one side of the valve is at test pressure and one side is at atmospheric pressure. Where greater than this force would be required to operate the valve with a lever, provide a gear operator. Unless different operators are scheduled or shown in the Drawings, conform to the following minimum requirements:
 - .1 Ball Valves: less than 150 mm, lever operator; greater than or equal to 150 mm, gear operator.
 - .2 Butterfly Valves: less than 250 mm, lever operator; greater than or equal to 250 mm, gear operator.
- .11 Gear operator to be worm gear type, equipped with a hand wheel and a visual indicator of the valve position. Equip operators with adjustable mechanical stop-limiting devices to prevent overtravel of the disc/ball in the open and closed positions and which are self-locking and designed to hold the valve in any intermediate position between full open and full closed. Gear operators must be grease lubricated. Where gear operators are intended for direct bury or submergence, seal units with long life lubricant.
- .12 Manual operators for butterfly and gate valves for buried service to include an AWWA operating nut and be gasketed and grease packed for submerged operation at water pressures to 700 kPa. Operators for exposed service must be gasketed for weatherproof service. Place gear boxes above ground and liquid surfaces.
- .13 Gear and manual operators for submerged service to be permanently lubricated and sealed for operation at water pressures to 700 kPa.

- .14 For manual valves on lines 75 mm and greater, mounted over 2.0 m above the operating floor, provide chain wheel gear operators. Design the operator so that a force of 150 N is sufficient to open the valve when one side of the valve is at test pressure and the other side is at atmospheric pressure. The chain pulley to mesh positively with the chain. Extend the chain from the valve operator to operating height 1.2 m above the floor or as directed by the Engineer. The exact dimensions must be field determined. Provide approved chain hooks where required to prevent chain from hanging within traffic paths.

2.5 BACK-FLOW PREVENTOR (BFP)

- .1 Supply and install BFP to prevent back-siphonage or back-pressure reverse flow into the PW supply. Assembly to consist of pressure differential relief valve, two check valve assemblies and two shut-off valves.
- .2 Assembly to meet requirements of ASSE 1013, AWWA C511-92, CSA B64.5 and ULC
- .3 Materials of construction:
- | | | |
|--------------------------|---|--------------------------------------|
| Check valve body | - | FDA epoxy coated cast iron or bronze |
| Seat | - | bronze |
| Trim | - | SS |
| Relief valve body | - | bronze or epoxy coated cast iron |
| Test cocks | - | bronze ball valve |
| Temperature range | - | 5°C to 40°C |
| Maximum working pressure | - | 1200 kPa |
| Design standard | - | Watts Series 909 |

2.6 PRESSURE REDUCING VALVE (PRV)

- .1 Provide valve stem extensions where additional clearance is required for pipe insulation, where valve operation without the extension is difficult, and in manholes.
- .2 Where angle valve stem extensions are employed, they must be angle geared. Universal joint types are not permitted.

2.7 INSULATION

- .1 For insulated pipe runs, insulate valves in accordance with Section 23 07 19 Thermal Insulation for HVAC Piping.
- .2 Preform insulation in a shape suitable for the valve, of the same material specified in Section 23 07 19 Thermal Insulation for HVAC Piping.
- .3 Recovering to be as specified in Section 23 07 19 Thermal Insulation for HVAC Piping, with transition sections for the joints between the valve insulation and the pipe insulation.

- .4 Insulation to be removable and reusable without destroying insulation or recovering.

2.8 PROTECTIVE COATINGS

- .1 Unless otherwise specified, provide valves coated in accordance with Section 40 05 30 Process Piping and Coating Systems.

2.9 CATHODIC PROTECTION

- .1 Unless otherwise specified, provide cathodic protection to underground valves.

2.10 SPARE PARTS

- .1 Provide one spare valve including the appropriate operator for each valve type and size.
- .2 Provide a list of all spare parts which would be expected to be required under normal conditions for a period of five years. At the Engineer's request, provide pricing for these parts.

Part 3 Execution

3.1 PREPARATION

- .1 The valve and piping arrangement indicated in the Drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in the piping to allow for discrepancies between the valve dimensions shown and those supplied for the work.
- .2 Prior to the installation of the valves, field measure and check all equipment locations, pipe alignments, and structural installation. Ensure that the valve location and orientation provides suitable access to manual operators and that sufficient space and accessibility is available for pneumatic and electric actuators.
- .3 Where conflicts are identified, inform the Engineer and initiate the necessary piping modifications at no cost to the Owner.

3.2 VALVE INSTALLATION

- .1 Install valves in conjunction with the piping described in Sections 40 05 13.01 Process Piping and with control valves and their appurtenances described in Division 25.
- .2 In horizontal pipe runs other than in locations where space does not permit, mount all valves except for butterfly valves and trunnion ball valves with a vertical operating shaft with the actuator at the top. In no case install a valve with the operator shaft pointing down.
- .3 Mount butterfly valves and trunnion ball valves with the shaft in a horizontal orientation.

- .4 When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.
- .5 Support valves in position using temporary supports until valves are fixed in place.
- .6 Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.
- .7 Where valves are installed in PVC pipework greater than 100 mm diameter, support valves independently and brace against operating loads and torque to prevent transmission of stresses to the PVC pipework.
- .8 Generally pipe supports and hangers are not shown unless for indication purposes only.
- .9 Install gate valves in the closed position.
- .10 Install valves which are bubble tight in one direction to seal in a direction opposite to normal flow unless otherwise noted or directed by the Engineer.
- .11 Unless otherwise specified, install single seated ball valves and knife gate valves with the seat downstream. Install at tank connections with seat away from tank. Install on pump discharge and suction lines with seat adjacent to the pump.
- .12 Install all valves in accordance with the Manufacturer's recommendations.
- .13 Protect valves installed below grade with a shrink sleeve or polyethylene sheath attached to the pipe with tapewrap.

3.3 VALVE EXTENSIONS

- .1 Install valve stem extensions where necessary to provide clearance from insulation.

3.4 INSULATION

- .1 Install insulation and recovering as specified in Section 23 07 19 Thermal Insulation for HVAC Piping.

3.5 VALVE TESTING

- .1 Operate valves under simulated and/or real process conditions to ensure they operate as intended.
- .2 Pressure test the valves in conjunction with the pipes in which the valves are installed as specified in Section 40 05 13.01 Process Piping

BF01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Butterfly Valve	BF01	Air	850	5-25	1140	38
TYPICAL SERVICE						
PA						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	Cast Iron / Ductile Iron		Size Range		50 mm to 600 mm	
Disc	Ductile Iron		Rating		850 CWP	
Disc Trim	Bronze or Nickel (Note 1)		Body/Valve Ends		Lugged (Note 2)	
Seats	EPDM		Type of Disc			
Shaft	Stainless Steel (416)		Operator		Note 3	
			Actuator		Note 4	
			Lining			
			Coating			
NOTES						
1. Full bronze disc for valves below 300 mm.						
2. Full lug, wafer style body for placement between two Class 125 flanges.						
3. See Division 25.						
4. Provide valves for CWP 1400 kPag on IA.						
5. Provide valves with 304 stainless steel body and disc for PA system submerged locations.						
ACCEPTABLE PRODUCTS						
Keystone 222 Series and Keystone GRW Series		Bray Series 31	DeZurik BRS		Center Line Series 200	
Nibco D2000 (150 PSI)		Grinnell Series 8000	Crane Resilient Seat			
Kitz		Vic 300 Masterseal	Vic series 763 (submersed service)			

BF02

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Butterfly Valve	BF02	Liquid	600	8-28	1350	38
TYPICAL SERVICE						
DSUB						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	Cast Iron		Size Range		50 mm to 600 mm	
Disc	Ductile Iron		Rating		1350 CWP	
Disc Trim	Bronze or Nickel (Note 1)		Body/Valve Ends		Lug Wafer (Note 2)	
Seats	Buna-N		Type of Disc			
Shaft	Stainless Steel (416)		Operator			
			Actuator		Electrical (Note 3)	
			Lining			
			Coating			
NOTES						
1. Full bronze disc for valves below 200 mm.						
2. Full lug, wafer style body for placement between two Class 125 flanges. In steel piping provide weldneck flanges on each side of valve.						
3. All actuators must be electrically operated and manufactured by the same supplier as the selected acceptable products.						
ACCEPTABLE PRODUCTS						
Keystone F222 and Keystone GRW		Bray Series 31H	DeZurik BRS		Center Line Series 200	
Kitz DJ Series		Nibco LD2000	Crane		Valmatic Series 2000	

BV02

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve	BV02	Gas	910	5-120	1400	120
TYPICAL SERVICE						
PA						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		Body Material: ASTM A351	
Body	Stainless Steel		Size Range		10 mm to 65 mm	
Ball	Stainless Steel – floating		Rating		CWP 1000 kPag	
Packing	Reinforced PTFE		Body/Valve Ends		Female Threaded	
Seats	Reinforced PTFE		Pattern		Compact, Full Port	
Shaft	Stainless Steel (Note 1)		Operator			
			Actuator		Lever	
			Lining			
			Coating			
NOTES						
1. Blowout-proof stem.						
2. When this valve is installed into a gas service it must comply with the applicable requirements						
ACCEPTABLE PRODUCTS						
Crane 9501		Kitz Type 600 UTKM		Neles Jamesbury 3000M		Watts

BV04

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve	BV04	Liquid	1000	5 to 30	1400	50
TYPICAL SERVICE						
ML, WAS, DSUB						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	Carbon Steel or Stainless Steel		Size Range		10 mm to 64 mm (Note 2)	
Ball	Stainless Steel (304)		Rating		CWP 1400 kPag	
Seats	PTFE or RTFE		Body/Valve Ends		Female Threaded	
Shaft	Stainless Steel (304 or 315) (Note 2)		Pattern		Compact, Full Port	
			Operator			
			Actuator		Lever	
NOTES						
1. Blowout proof stem.						
ACCEPTABLE PRODUCTS						
Velan M1113 or M1102		Watts C-FBV/S-FBV		Trueline N620		

BF05

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Butterfly Valve	BF05	Air	75	121	345	121
TYPICAL SERVICE						
PA						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL					
Body	Cast Iron		Size Range		600 to 1050 mm	
Disc	Stainless Steel (316)		Rating		CWP 1035 kPag	
			Body/Valve Ends		Class 150 flanged, lug body	
Seats	EPDM (replaceable type)					
Shaft	Stainless Steel (316)		Operator		Note 2	
			Actuator		Note 3	
NOTES						
1. Bidirectional bubble-tight shutoff required.						
2. See Division 25						
ACCEPTABLE PRODUCTS						
Bray Series 35/36		Pentair / Keystone Fig. AR2		Dezurik AWWA valve		

BF07

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Butterfly Valve	BF07	Air	75	5-120	850	120
TYPICAL SERVICE						
PA						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	Cast Iron or Carbon Steel		Size Range		75 mm to 600 mm	
Disc	Stainless Steel (316)		Rating		Class 150	
Disc Trim	N/A		Body/Valve Ends		Wafer	
Seats	Reinforced PFTE		Type of Disc		Eccentric	
Shaft	Stainless Steel (316)		Operator		Gear Operator (Note 1)	
			Actuator		(Note 2)	
			Lining			
			Coating			
NOTES						
1. Refer to Division 25						
ACCEPTABLE PRODUCTS						
Fisher 8560	Jamesbury L1C		Keystone K-Lok			

BV05

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve	BV05	Liquid, Sludge	80 – 900	5 - 20	1000	40
TYPICAL SERVICE						
DSUB, TWAS						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		MSS-SP72 (Note 2)	
Body	Cast Steel or Cast Iron or Steel		Size Range		75 mm to 450 mm	
Ball	Stainless Steel (304 or 316)		Rating		CWP 1400 kPag	
Packing	Reinforced PTFE or AFE		Body/Valve Ends		Split Body, Flanged (Note 2)	
Seats	Reinforced PTFE		Pattern		Full Port	
Shaft	Stainless Steel (304 or 316) (Note 1)	Operator		Notes 1, 2		
		Actuator				
		Lining		Note 5		
NOTES						
1. Blowout proof stem.						
2. Provide Class 125 to suit cast or ductile iron piping systems and Class 150 for steel systems.						
3. Provide trunnion mounted ball on all valves 250 mm diameter and greater.4						
ACCEPTABLE PRODUCTS						
Kitz 150 SCTBZM		Watts G4000/G4000T	Velan F-01402-SSGA		Jamesbury Series 7000	
American Valve Model 4000						

BV16

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve	BV16	Liquid, Sludge	2400	30	3570	100
TYPICAL SERVICE						
DSUB, TWAS						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		ASME B16.10	
Body	316 Stainless Steel ASTM A182 F316		Size Range		50 – 200mm	
Ball	316 Stainless Steel ASTM A182 F316		Rating		ASME B16.34, Class 300	
Steam Seal	Viton		Body/Valve Ends		Flange	
Seats	PTFE reinforced		Pattern		3-piece body, full port	
Shaft	316 Stainless Steel		Operator		Note 2	
Seal	Manufacturer's Standard		Actuator			
Bearings	Manufacturer's Standard for sludge service					
NOTES						
1. Trunnion mounted ball required.						
2. Provide handwheel operator for manual valves.						
ACCEPTABLE PRODUCTS						
Val-Matic Quadrosphere						

CV02

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Check Valve	CV02	Liquid	600	5-30	850	50
TYPICAL SERVICE						
DSUB, DR, WAS, TWAS						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document	AWWA C508		
Body	Cast Iron		Size Range	75 mm to 600 mm		
Disc	Cast or Ductile Iron		Rating	Class 125, ANSI B16.1		
Seats	Bronze		Valve Ends	Flanged		
Hinge pin, trim	Stainless steel		Type of Disc	Swing Check (Note 1)		
			Operator	(Note 1)		
			Actuator			
			Lining			
			Coating			
NOTES						
1. For all check valves on pump discharges, provide weighted lever arm. 2. Valves to be glass-lined for sludge service.						
ACCEPTABLE PRODUCTS						
Mueller	Dezurik-APCO		Milliken			
Valmatic	Henry Pratt					

CV04

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Check Valve	CV04	Gas	600	5-170	900	190
TYPICAL SERVICE						
Air, PA						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		Note 3	
Body	Stainless Steel		Size Range		75 mm to 750 mm	
Disc	Stainless Steel		Rating		Class 125	
Seats			Valve Ends		(Note 1)	
Hinge pin, trim	Stainless Steel		Type of Disc		Split Disk/Double Leaf	
Spring	Stainless Steel		Operator			
			Specials		(Note 2)	
NOTES						
1. Wafer Body for mounting between Class 150 flanges.						
2. Provide lifting lugs on valve greater than 50kg.						
3. When this valve is installed into a gas service it must comply with the applicable requirements						
ACCEPTABLE PRODUCTS						
APCO 9000		Val-Matic 8000	Proquip Twin Flapper		Mission 12 HMP	
Gulf MB12-5-0-9-1-5-F		Center Line Series 800				

CV08

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Check Valve	CV08	Liquid	600	25	1000	38
TYPICAL SERVICE						
DR						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		ASTM A351; ASME B16.34	
Body	316 Stainless Steel		Size Range		100 mm	
Disc	316 Stainless Steel		Rating		Class 150	
Disc Trim	316 Stainless Steel		Valve Ends		Flange	
Seats	316 Stainless Steel		Type of Disc		Swing	
Pin	316 Stainless Steel					
NOTES						
ACCEPTABLE PRODUCTS						
Kitz AK150UOAM		Crane Aloyco 377				

CV10

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Check Valve	CV10	Liquid	2900	5-30	3500	50
TYPICAL SERVICE						
DSUB, DR, WAS, TWAS						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	Cast Iron		Size Range		150 mm	
Disc	Cast or Ductile Iron		Rating		Class 250	
Seats	Bronze		Valve Ends		Flanged	
Hinge pin, trim	Stainless steel		Type of Disc		Swing Check (Note 1)	
			Operator		(Note 1)	
NOTES						
1. For all check valves on pump discharges, provide weighted lever arm.						
ACCEPTABLE PRODUCTS						
Crane 370 series; 147XU		APCO Series 6000-Convertible		Newman Hattersley 651	Terminal City	
Jenkins 587		Powell 559		Lunkenheimer 1790	Toyo Fig 435A	
Kitz Fig 78						

GL01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Globe Valve	GL01	Liquid	600	5-120	1000	150
TYPICAL SERVICE						
DSUB						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		MSS SP-080	
Body	Cast Iron (Note 1)		Size Range		>65 mm (Note 1)	
Disc	294-s renewable composition		Rating		Class 150	
Seats	Stainless Steel (316)		Valve Ends		Flanged (Note 1)	
Seals			Type of Disc			
Shaft	Copper Alloy 864		Operator		OS&Y (Note 1)	
			Actuator			
			Lining			
			Coating			
NOTES						
1. For valves less than 65mm diameter: RS, union bonnet, threaded (ANSI B2.1) bronze body.						
ACCEPTABLE PRODUCTS						
Jenkins Fig. 142		Newman Hattersley 731 CD			Spirax Sarco	
Kitz Fig 76		Toyo Fig 400A				

GL02

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Globe Valve	GL02	Liquid	750	-5 to 115	1000	120
TYPICAL SERVICE						
DSUB						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		MSS SP-080	
Body	Bronze		Size Range		<=65 mm	
Disc	Polyurethane or PTFE		Rating		Class 125	
Seats	Bronze		Valve Ends		Female threaded	
Seals			Type of Disc			
Shaft	Stainless Steel 316 or Bronze ASTM B505		Operator		Handwheel rising stem	
			Actuator			
NOTES						
ACCEPTABLE PRODUCTS						
Kitz		Newman Hattersley				
Grinnell		Spirax Sarco				

NV01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Needle Valve	NV01	Liquid/Air	800	5-100	1000	140
TYPICAL SERVICE						
Air						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		(Note 1)	
Body	Stainless Steel		Size Range		10 mm to 65 mm	
Stem	Stainless Steel		Rating		Class 150, 600 psi	
Seats	Stainless Steel		Valve Ends		Female threaded (Note 1)	
Seals/Packing	PTFE		Type of Disc		Needle	
Handle	Stainless Steel or Phenolic		Operator		Screwed Bonnet, Handwheel	
			Actuator			
			Lining			
			Coating			
NOTES						
1. Female threads to suit commodity piping.						
ACCEPTABLE PRODUCTS						
Nupro JN Series		Anderson, Greenwood H Series	Lukenheimer 1733T		Parker FC-V12LNSS	
ECI Series 2000 FFG		Century CM2-IF44BT				

PLV01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Plug Valve	PV01	Liquid, Sludge	600	5-30	850	50
TYPICAL SERVICE						
DR, WAS, TWAS						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	Cast Iron		Size Range		80 mm to 750 mm	
Plug	Cast Iron (see plug coating)		Rating		Class 150	
Seats	Removed		Valve Ends		Grooved to AWWA C606 or Flanged	
Seals	Multiple Packing		Type of Plug		Eccentric	
Shaft	Steel		Operator		Note 1	
Bearings	Stainless Steel		Actuator			
Valve Port	Standard		Lining		Glass lined	
			Plug Coating		Buna-N, Al-Clad, or Hycar	
			Coating			
NOTES						
1. See Section 15100 Process Valves.						
ACCEPTABLE PRODUCTS						
Victaulic Fig 365		Pratt Ballcentric		Dezurik PEF		Valmatic Cam-Centric
Milliken						

ARV01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Relief or Backpressure Valve	RV01	Water	See Valve Schedule	5-30	To match piping system	To match piping system
TYPICAL SERVICE						
RS						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	316 Stainless Steel or Ductile Iron		Size Range		40 - 200 mm	
Diaphragm	EPDM or Buna N		Rating		Note 2	
Disc Trim	None		Body/Valve Ends		Note 3	
Seats	316 Stainless Steel		Pilot valves		316 Stainless Steel	
Shaft	Stainless Steel (316)		Operator		NA	
Bushings	Stainless Steel		Actuator		NA	
Spring	302 Stainless Steel		Lining		Epoxy (on Ductile Iron Body)	
Fastenings	SS		Coating		Epoxy (on Ductile Iron Body)	
NOTES						
1. Suitable for use with raw wastewater with suspended solids. 2. Class 125 or Class 250 to match piping system where the valve is to be used. 3. Provide flanged end connections for valves 50mm and larger. Threaded connections are acceptable for valves smaller than 50mm. 4. Control valve shall be pilot operated an arranged to act as a relief valve or backpressure valve and maintain a constant pressure upstream of the valve. 5. Valves for use in potable water service shall meet requirements of NSF 61. 6. See Drawings and Valve Schedule for setpoint.						
ACCEPTABLE PRODUCTS						
Singer 106/206-RW	Cla-Val					

SV01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Solenoid Valve	SV01	Liquid	1000	5 to 30	1400	50
TYPICAL SERVICE						
EW, PSW						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document			
Body	Stainless Steel		Size Range		10 mm to 64 mm (Note 2)	
Plug	Stainless Steel		Rating		CWP 1400 kPag	
Seats	PTFE or RTFE		Body/Valve Ends		Female Threaded	
Shaft	Stainless Steel		Pattern			
			Operator			
			Actuator			
NOTES						
ACCEPTABLE PRODUCTS						
ASCO						

1.1 GENERAL

1.2 SECTION INCLUDES

- .1 This Section specifies coating systems, surface preparations, and application requirements for Process system requirements (in general, systems not specified by the architect). Galvanizing does not form part of this Section.
- .2 Surface preparation, factory prime coating, factory finish coating and factory assembly and protection for all components to be provided with corrosion protection coatings.
- .3 Surface preparation, site prime coating, site finish coating and protection for all elements to be provided with corrosion protection coatings.
- .4 For equipment supplied under the Novation Agreements, refer to the applicable specification Sections under the Equipment Supply Contracts to determine responsibility of Painting and Coating Systems.
- .5 Coordination and cooperation with Independent Testing/Inspection Agencies to be retained by the Owner.

1.3 RELATED SECTIONS

- .1 Division 40
- .2 Division 43
- .3 Division 46

1.4 REFERENCES

- .1 ASTM D16, Standard Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- .2 ASTM D2200, Pictorial Surface Preparation.
- .3 ASTM D3359, Methods for Measuring Adhesion by Tape Test-Method A.
- .4 ASTM D3960, Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
- .5 ASTM D4417, Field Measurement of Surface Profile of Blast-Cleaned Steel.
- .6 SSPC, Steel Structures Painting Council Specifications, Vol. 1, Good Painting Practice.
- .7 SSPC, Steel Structures Painting Council Specifications, Vol. 2, Systems and Specifications.
- .8 Industrial Health and Safety Regulations, Workers' Compensation Board of Nunavut (WCB).

- .9 NACE: 6Q187, Current Practices in Quality Control during Application of protective Coating Materials.
- .10 NACE: RP0178, Standard Recommended Practice – Fabrication Details, Surface Finish Requirements and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service.

1.5 DEFINITIONS AND INTERPRETATIONS

- .1 Specific coating terminology used in this Section is in accordance with definitions contained in ASTM D16, ASTM D3960, and the following definitions:
 - .1 Painting: The process of applying a coating system.
 - .2 Coating: Covering layer(s) of protecting substance(s).
 - .3 Dry Film Thickness (DFT): The thickness of one fully cured continuous application of coating.
 - .4 Coating System Thickness: The total dry film thickness of primer and finish coats.
 - .5 Prime Coat: First full coating - does not include conditioners, vinyl acid wash coats, sealers or pre-treatment applications.
 - .6 Factory Applied Finish Coat: One or more coats applied in a shop or plant prior to shipment to the site, where only touch-ups are required.
 - .7 Field Coat: The application or the completion of application of the coating system after installation of the surface at the site of the work.
 - .8 Shop Coat: One or more coats applied in a shop or plant prior to shipment to the site, where the field or finishing coat is applied.
 - .9 Tie Coat: An intermediate coat used to bond different types of paint coats. Coatings used to improve the adhesion of a succeeding coat.
 - .10 Vinyl Acid Wash Coat: A coating supplied as one- or two-component systems on clean light alloy or ferrous surfaces, and on many non-ferrous surfaces, to provide adhesion with the substrates, and for the application of subsequent coats of paint.
 - .11 Photochemically Reactive Organic Material: Any organic material that will react with oxygen, excited oxygen, ozone or other free radicals generated by the action of sunlight on components in the atmosphere giving rise to secondary contaminants and reaction intermediates in the atmosphere which can have detrimental effects.
 - .12 Volatile Organic Content (VOC): The portion of the coating that is a compound of carbon, is photochemically reactive, and evaporates during drying or curing, expressed in grams per litre.
 - .13 Touch-Up: The application of a coating on areas of coated surfaces to repair marks, scratches, and areas where the coating has deteriorated to restore the coating film to an unbroken condition.
 - .14 COATSPEC: Coating system specification sheets.

- .15 Submerged Service: Equipment or material fully, partially or intermittently submerged in wastewater during routine plant operation.
- .16 Splash Zone Service: Equipment or material exposed to the normal range of atmospheric conditions and conditions common to wastewater treatment facilities (high humidity, H₂S, etc.).
- .17 Indoor Service: Equipment or material inside buildings or other ventilated spaces.
- .18 Outdoor Service: Equipment or material outside buildings or other ventilated spaces, exposed to weather elements.

1.6 RESTRICTIONS

- .1 Regardless of whatever else is specified in this Section, no paint containing a chromate based additive can be used. Substitute products of equal or greater quality.
- .2 Prior to using of any grout or filler to smooth the metal surface, in the event that the surface is not accessible to grind smooth, obtain permission from the Engineer.

1.7 SUBMITTALS

- .1 With the equipment shop drawings, the Contractor must submit details of the factory applied prime and finish coat systems to be applied.
- .2 Submit colour chart in accordance with Section 01 33 00.
- .3 Submit a complete list of all coatings used in this Contract in accordance with Section 01 33 000. The list is to include the following information: location of application, system identification, manufacturer, product, (prime and finish coats) colour identification code, supplier and date of completion.

1.8 QUALITY CONTROL

- .1 Particular attention must be paid to ensure the compatibility of each surface treatment with the preceding and subsequent surface treatments and coatings. The Contractor must be responsible for the compatibility of all surface treatments and coatings.
- .2 Provide materials and supplies that are the standard products of manufacturers. Provide materials in each coating system that are the products of a single manufacturer.
- .3 Do not use coating products until the Engineer has inspected and reviewed the materials.
- .4 Strictly adhere to all manufacturer's printed recommendations with respect to ambient conditions at time of application, drying times, application method, mixing instruction, application equipment, pot life, thinning and any other manufacturer's recommendations deemed applicable by the Engineer.

1.9 SHIPMENT, PROTECTION AND STORAGE

.1 Coatings

- .1 Deliver materials to the job site in their original, unopened containers. Provide on each container the manufacturer's name, coating type, batch number, date of manufacture, storage life, colour special directions and Manufacturer's material safety data sheets. Identify all toxic substances.
- .2 When storage life is not specified, obtain manufacturers certification of paint integrity one (1) year after date of manufacture, prior to use.
- .3 Store materials in enclosed structures and protect from weather. Maintain temperature within manufacturer's recommended storage range. Store flammable materials in accordance with provincial and local codes.
- .4 Use materials with oldest date of manufacture first.
- .5 Remove from the site materials exceeding storage life recommended by the manufacturer.

.2 Coated Surfaces

- .1 Items which are to be bolted together before shipment must have their surfaces prepared and coated before the parts are assembled.
- .2 All coated equipment must be protected adequately against damage, dust, moisture and scratching during shipment, off-loading and storage on site.
- .3 Damage to coatings occurring at any time must be made good prior to the application of any further coatings.
- .4 After delivery to the site and after permanent erection or installation, factory-coated metalwork must be re-coated or retouched by the Contractor.
- .5 Tag, lift and ship in such a manner as to minimize damage to equipment coatings.
- .6 If, in the opinion of the Engineer, the coating is damaged during shipment to the extent that touch-up would not be satisfactory, the equipment must be returned and re-coated at no change in the Contract Price.

.3 Safety And Ventilation Requirements

- .1 Meet requirements for safety and ventilation in accordance with SSPC and all applicable regulations and codes.

.4 Warranty

- .1 The Engineer will notify in advance of an inspection of applied coatings prior to expiry of the warranty period. A list of all coating defects and failures will be prepared and transmitted.
- .2 All defective coatings to be repaired using coating materials, equipment and methods similar to those used in the original work. Materials to be of

fresh manufacture and within the manufacturer's stated shelf life at the time of application.

- .3 Within 90 calendar days of this inspection, the Contractor must arrange to have all required coating repairs completed.

Part 2 Products

2.1 ACCEPTABLE PRODUCTS

- .1 The following list specifies the material requirements for coating systems. Coating systems are categorized by generic name followed by an identifying abbreviation. If an abbreviation has a suffix number, it is for the purpose of identifying subgroups within the coating system.

Coating System	Manufacturer	Product Designation	
		Prime Coat(s)	Finish Coat(s)
Epoxy			
E-1	Amercoat Canada*	Amercoat 385 or Maercoat 370	N/A
	Carboline	Carbolin 890	None (1 coat)
	Cloverdale	Clovaguard 83150	Clovaguard 83150 (if required)
	Devoe Coatings	Devran 224 or Bar Rust 235 (application in the field)	None (1 coat)
	Hempel	Hempadur Mastic 45880	None (1 coat)
	International	Intergard 345 FD or Interseal 670 HS	Intergard 345 or 670 HS
	Rust-Oleum	9100	None (1 coat)
	Sherwin Williams	N/A	N/A
	Tnemec	Series 1 Purple Prime	Series 161 Tneme-Fascure
E-2a	Amercoat Canada	Amerlock	Amerlock
	Carboline	Carboline 890	Carboline 890
	Cloverdale	Clovaliner 83295	Clovaliner 83295
	Devoe Coatings	Bar Ruse 236	Bar Rust 236
	Hempel	Hempadur 15500	Hempadur 15500
	International	Interseal 670 HS	Interseal 670 HS
	Rust-Oleum	9100	9102
	Sherwin Williams	N/A	N/A
	Tnemec	Series 1 Purple Prime	Series 164 Expoxoline 80
E-2b	Amercoat Canada	Dimetcote 9 or Dimecote 21-5 (inorganic zinc) Amercoat 68 A (organic zinc)	Amercoat 385 or Amercoat 370
	Carboline	Carboline 589 (organic zinc)	Carboline 890 or Carbothane 133 HB (for lasting color)
	Cloverdale	Clovazinc 2 (inorganic) Clovazinc 3 (organic)	Clovaliner 83295
	Devoe Coatings	CathaCoat 302H (organic zinc)	Devran 224 HS or Bar Rust 235, optional Devran 359

	Hempel International Rust-Oleum Sherwin Williams Tnemec	Hempel's Galvosil 15700 Interzinc 52 9100 N/A N/A	Hempadur Mastic 45880 Intergard 345 or 670 HS 9102 N/A N/A
E-2c	Amercoat Canada Carboline Cloverdale Devoe Coatings Hempel International Rust-Oleum Sherwin Williams Tnemec	Amerlock N/A Clovaliner 83295 Bar Rust 236 N/A (for acidic environment recommends vinyl ester) Interseal 670HS N/A N/A Series 1 PurplePrime	Amerlock N/A Clovaliner 83295 Bar Rust 236 N/A Interseal 670HS N/A N/A Series 164 Epoxoline 80
High Heat			
HH-1	Amercoat Canada Carboline Cloverdale Devoe Coatings Hempel International Rust-Oleum Sherwin Williams Tnemec	Dimetecote 9 or Dimecote 21- 5 (waterborne) Carbozinc 11 Clovazinc 2 Cathacoat 304 L Hempel's Galvosil 15700 Interzinc 22 N/A Zinc Clad II ES Series 90-96 Tneme-Zinc	PSX 892 (if required) 4900 (if required) Clovatherm 83220 Cathacoat 304 L plus HT- 10 aluminum topcoat (if required) None (1 coat) None (1 coat) N/A Kem Hi Temp 850 None (1 coat)
Latex			
L-1	Amercoat Canada General Paint Carboline Cloverdale Devoe Coatings Hempel International Rust-Oleum Sherwin Williams Tnemec	Amercoat 146 51087 Superseal Carbocrylic 120 05250N 36 600 ultra Hemucryl TI-coat 18200 Intercryl 520 5200 Heavy Duty Block Filler Series 130 Envirofill for concrete or masonry Series 51-792 PVA sealer for drywall	Amercoat 220 58-020 High Performance 2000 Carbocrylic 3359 70625 94 800 ultra Hemucryl Enamel HI-Build 58030 Intercryl 530 5200 Metalatex Semi-Gloss Series 29 Tufcryl
L-2	Amercoat Canada General Paint Carboline Cloverdale Devoe Coatings	Amercoat 146 11011 Plastic Primer Carbocrylic 120 05910 Gripper 3210, optional Devflex 659 DTM	Amercoat 220 15-020 Envirogard Semi gloss Carbocrylic 3359 706-Series Lifemaster- Pro 4216 semi- gloss, optional Devflex 659 DTM

	Hempel International Rust-Oleum Sherwin Williams Tnemec	Hemucryl TI-coat 18200 Intercryl 520 3100 or 3700 (not for plastic or fiberglass) DTM Primer Series 151 Elasto-Grip FC	Hemucryl Enamel HI-Build 58030 Intercryl 530 3100 or 3700 DTM Finish Series 29 Tufcryl
L-3	Amercoat Canada General Paint Carboline Cloverdale Devoe Coatings Hempel International Rust-Oleum Sherwin Williams Tnemec	Amercoat 148 15-002 Envirogard Primer Carbocrylic 3358 15910 Devguard 4160 Series, optional Devflex 659 DTM Hemucryl TI-Coat 18200 Intercryl 520 3100 or 3700 (not for plastic or fiberglass) DTM Primer Series 18 Enviro-Prime	Amercoat 220 15-020 Envirogard Semi Gloss Carbocrylic 3359 706- Series Lifemaster- Pro 4216 semi- gloss, optional Devflex 659 DTM Hemucryl Enamel HI-Build 58030 Intercryl 530 3100 or 3700 DTM Finish Series 29 Tufcryl
Urethane			
U-1	Amercoat Canada General Paint Carboline Cloverdale Devoe Coatings Hempel International Rust-Oleum Sherwin Williams Tnemec	Amercoat 385 or Amercoat 370 Amercoat 385 or Amercoat 370 Carboline 893 or 890 Clovanguard 83150 Devran 224 HS or Bar Rust 231 Hempadur Mastic 45880 Intergard 345 9100 Tile Clad II Epoxy Primer Series 1 PurplePrime	Amercoat 450 HS Urethane General Paint Indurathane Carbothane 134 HG Clovathane Devthane 369 or 359 Hempel's Urethan 5595U (high gloss) Interthane 990 9700 Hi Build Aliphatic Polyurethane Series 73 Endura-Shield
U-2	Amercoat Canada General Paint Carboline Cloverdale Devoe Coatings Hempel International Rust-Oleum	Amerlock Surface Tolerant Expody N/A Carbomastic 15 or 15FC Abrade surface or bonding primer Devran 224 HS or Bar Rust 231 Hempadur Mastic 45880 (intermediate coat for repair) Abrade surface or bonding primer 9100	Amercoat 450 HS N/A Carbothane 134HS Clovathane Devthane 369 or 359 Hempel's Urethane 5595U (high gloss) Hempathane Topcoat 55210 (semi-gloss) Interthane 990 9700

	Sherwin Williams Tnemec	N/A Series 135 Chembuild	N/A Series 73 Endura Shield

2.2 TYPE F2 – ACID RESISTANT SEALER –

- .1 TWAS Tanks Area
 - .1 CIM 1000 Urethane Coating: Produced by CIM Industries -Peterborough NH.
 - .2 SIKA FastFlor CR Epoxy Coating – Produced by SIKA Canada - Edmonton AB
 - .3 Contactor to provide submittal and data sheets for comparable coatings.

Part 3 Products

3.1 GENERAL

- .1 Coated Surfaces
 - .1 Items or areas which have been coated are not be handled, worked on, or otherwise disturbed, until the coat is completely dry and hard.
- .2 Prime Coats
 - .1 Unless otherwise specified, prime coats may be shop or field-applied.
 - .2 Prime coat may be thinned and applied as recommended by the manufacturer, provided the coating, as applied, complies with prevailing air pollution control regulations.
 - .3 Shop-applied primer to be compatible with the specified coating system and applied at the minimum dry film thickness recommended by the manufacturer.
 - .4 Touch up factory prime coat before applying the finish coat(s) to achieve the specified film thickness and continuity.
 - .5 Provide product data sheets identifying the shop primer used, to the on-site finish coat applicator, if applicable.
- .3 Finish Coats
 - .1 Unless otherwise specified, finish coats may be shop or field-applied.
 - .2 Unless otherwise specified, do not apply finish coats until all previous coats have been inspected.
 - .3 Do not apply finish coats until other work in the area is complete and until all previous coats have been inspected, unless otherwise specified.
- .4 Electrical and Instrumentation Equipment

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1- 1955.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y- 1-1958
 - .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
 - .4 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

3.2 PREPARATION

- .1 Surfaces to be painted are to be clean and dry. Before applying coating or surface treatments, remove oil, grease, dirt, rust, loose mill scale, old weathered coatings, and other foreign substances except as specified.
- .2 Where mechanical cleaning is accomplished by blast cleaning, the abrasive used is to be washed, graded and free of contaminants that might interfere with the adhesion of the coatings.
- .3 No more surface is to be blasted than can be prime coated before visible or detrimental re- rusting occurs.
- .4 Examine all surfaces to be painted and correct all surface defects before application. Remove weld splatter, high ridges and slag prior to painting.
- .5 Use clean cloths and clean fluids in solvent cleaning.
- .6 Schedule cleaning and painting so that dust and spray from the cleaning process will not fall on wet, newly painted surfaces.
- .7 When field coating, remove or mask hardware, hardware accessories, nameplates, data tags, machined surfaces, sprinkler heads, electrical fixtures, and similar uncoated items which are in contact with coated surfaces prior to surface preparation and painting operations. Following completion of painting, reinstall removed items complete with all tags, labels and/or attached instruction or data sheets. Replace damaged items caused by removal at no expense to the Owner.
- .8 In the field, disconnect and move equipment adjacent to walls such as cables or cover plates, to permit cleaning and painting of equipment and walls and replace and reconnect on completion. Mask and paint around large panels or equipment.
- .9 Lightly sand glossy undercoats to provide a surface suitable for the proper application and adhesion of subsequent coats.

3.3 PAINTING EXISTING FACILITIES

- .1 Paint existing equipment and metalwork in accordance with the appropriate coating system specified for new work.

- .2 Modified work will require the full coating system. Other work will require cleaning followed by two finish coats of the appropriate system.
- .3 Demonstrate that the existing coating is compatible with field coating by performing an adhesion test as specified herein. Where unacceptable test results are obtained, follow manufacturer's written instructions as to the necessity of a tie coat to provide a satisfactory bond between the existing coating and the specified field coating.
- .4 Sandblast surfaces to be coated. On irregular concrete surfaces, apply surfacing material compatible with coating system as necessary to ensure a smooth level surface on which to apply coating system specified. Repair, clean, and finish surfaces to be coated or re-coated as specified herein.

3.4 WORKMANSHIP

- .1 Coated surfaces to be free from runs, drops, ridges, waves, laps, and brush marks. Paint so as to produce an even film of uniform thickness completely coating corners and crevices. Paint in accordance with the requirements of SSPC.
- .2 Coated surfaces to be free from gaps or holidays. Any gaps or holidays found during inspection to be touched-up by roughening surface around the fault and repainting at no expense to the Owner.
- .3 Apply each coat of paint evenly and to a sharply cut line. Exercise care to avoid over-spraying or spattering paint on surfaces not to be coated.
- .4 In the field, protect glass, hardware, floors, roofs, and other adjacent areas and installations with taping, drop cloths, or other suitable measures.

3.5 MIXING AND THINNING

- .1 Mixing and thinning to be performed by qualified personnel only.
- .2 Coating material to be thoroughly stirred, strained, and kept at a uniform consistency during application.
- .3 Mix coatings consisting of two or more components in accordance with the manufacturer's instructions.
- .4 Thin coatings where necessary to suit the conditions of the surface, temperature, weather and method of application, immediately prior to use. The volatile organic content (VOC) of the coating as applied is to comply with prevailing regulations and codes.
- .5 Do not reduce coating more than necessary to obtain the proper application characteristics.
- .6 Thinner to be as recommended by the coating manufacturer.

3.6 ENVIRONMENTAL REQUIREMENTS

- .1 Apply coating material only to surfaces that are dry, and only under conditions of evaporation rather than condensation.

- .2 Do not apply materials during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation.
- .3 During damp weather, when the temperature of the surface to be coated is within 3°C of the dew point, heat surfaces to prevent moisture condensation thereon. Bare metal surfaces, except those which may be warped by heat, may be dehydrated by flame-heating devices immediately prior to coating application.
- .4 During coating, and for a period of at least eight (8) hours after the coating material has been applied, maintain the temperature of the surfaces to be coated, the coated surfaces, and the atmosphere in contact at or above 10°C, and at least 3°C above the dew point.
- .5 Coating material, when applied, to be approximately the same temperature as the surface on which it is applied.
- .6 Fans or heaters to be used inside enclosed areas where conditions causing condensation are severe.

3.7 EQUIPMENT

- .1 Ensure all coating equipment including but not limited to material pots, guns, fluid needles, air caps, brushes, and hoses are clean, in proper working order, and comply with the coating manufacturer's specifications. Clean any used equipment thoroughly with a solvent prior to being used with each new coating material and flush with solvents used in coating material. Contaminated hoses are to be promptly removed from service until cleaned or replaced.
- .2 Use equipment designed for application of the materials specified. Compressors to have suitable traps and filters to remove water, solids and oils from the air.
- .3 Perform a paper blotter test prior to application and when requested by the Engineer, to ensure the air contains less than the coating manufacturer's acceptable limits for oil and moisture.
- .4 Equip spray equipment with mechanical agitators, pressure gages, and pressure regulators, and spray nozzles of the proper sizes.

3.8 APPLICATION

- .1 The method of application used must be governed by the coating manufacturer's recommendation for the particular coating being applied, and to the requirements of SSPC Good Painting Practice.
- .2 Traps or separators must be provided to remove oil, solids and water from the air. The air from the spray gun impinging onto the steel substrate must show no condensed water or oil.
- .3 All weld areas and hard to spray areas must be hand brushed prior to the first spray coat application, with coating mixed to manufacturer's recommended procedures.

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- .4 No coatings must be applied to a surface at a temperature that will cause blistering, separation or otherwise be detrimental to the life of the coating.
 - .5 Only thinners specified by the manufacturer must be accepted.
 - .6 Materials that exceed manufacturer's published shelf life will not be accepted.
 - .7 All runs, sags, blistered, etc. must be brushed out immediately or the area must be removed and repaired prior to the next application.
 - .8 Coating is to be applied by conventional or airless spray as per coating manufacturer's data sheet.
 - .9 Supplier must follow manufacturer's application procedures as to recommended pressures, atomization, etc. as close as possible.
 - .10 Thoroughly examine all surfaces to be treated or coated prior to commencement of work. Report, in writing, to the Engineer any condition or defect that may affect the integrity or quality of the prime or finished coats. Do not commence work on any section until all such defects in that section have been corrected.
 - .11 Where two (2) or more coats are required, alternate coats are to contain sufficient compatible colour additive to act as indicator of coverage, or the alternate coats are to be of contrasting colours.
 - .12 Colour additives are not to contain lead, or any lead compound which may be destroyed or affected by hydrogen sulphide or any other corrosive gas.
 - .13 Mechanical equipment, on which the manufacturer's coating is acceptable, to be touch-up primed and painted with two coats of the specified coating system to match colour schedule.
 - .14 Do not paint coating to a surface until prepared as specified and inspected by the Independent Testing Agency.
 - .15 Apply the primer or first coat by brush to ferrous surfaces which are not blast-cleaned. All coats for blast-cleaned ferrous surfaces and subsequent coats for non-blast-cleaned ferrous surfaces may be either brush or spray applied.
 - .16 All areas inaccessible to the spray gun must be coated by brush, rollers, sheepskin dauber, or other suitable method.
 - .17 The inner face of bolt holes, not threaded, are to be cleaned and coated as required for other surfaces.
 - .18 After the prime coat is dry, mark and repair pinholes and holidays in accordance with coating manufacturer's recommendations and retest before succeeding coats are applied. Unless otherwise specified, coats for concrete and masonry to be brushed or rolled.
 - .19 Do not exceed manufacturer's recommended surface area coverage per volume of coating material for various types of surfaces.
 - .20 The finished coating will be free of obvious defects such as runs, sags, blisters or pinholes, air entrapment, fish-eyes and foreign matter.

- .21 Unless otherwise specified, the average total dry thickness of any completed protective coating system on exposed metal surfaces is not to be less than 100 microns (4 mils) per coat.
- .22 Paint full coating system prior to erection of any elements in areas inaccessible to painting after erection, such as pipe hangers, piping in contact with hangers, and any contact surfaces.
- .23 Areas damaged during erection to be hand-cleaned or power-tool cleaned and repainted with primer coat prior to the application of subsequent coats. Touch-up all surfaces after installation.
- .24 Remove and after painting replace or adequately mask all grease nipples, bright metal surfaces, identification plates and other items not to be painted. Do not use solvent that may remove permanent lacquer finishes.
- .25 After acceptance of coating, all masking, grease, etc., must be removed from all equipment which was not intended to be coated.

3.9 DRYING AND CURING

- .1 All drying and re-coat times must be that specified by the manufacturer's specifications.
- .2 Cure time must be as specified by the manufacturer's published literature.

3.10 FIELD TOUCH-UPS

- .1 Field touch-ups and field applied protective and maintenance coatings will be undertaken by the Contractor as per the schedule of surface treatments outlined in Part 2 – Products.

3.11 TESTING AND INSPECTION

- .1 Surface preparation of material to be coated, coatings, and coating application will be inspected by an Independent Testing Agency specializing in this work. The Independent Testing Agency will be retained by the Owner. The Independent Testing Agency will use NACE certified coating inspectors to conduct examinations and tests.
- .2 The Independent Testing Agency must have the right to request tests, to witness the performance of tests, or to perform tests. Inspection and testing, to be coordinated with the Independent Testing Agency, must be conducted as a minimum at the following times:
 - .1 After sandblast and immediately prior to coating application
 - .2 After coating cure.
 - .3 After field assembly of the equipment.
- .3 Inspection by the Independent Testing Agency does not relieve any responsibility for guarantee of the coating application from the Contractor.

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- .4 On the first day of sandblasting operations, the Contractor must sandblast sample metal panels to the standards specified. Plates to measure a minimum of 220 mm by 280 mm. Panels meeting the requirements of the specifications are to be initialled by the Contractor and the Independent Testing Agency and painted with a clear non-yellowing coating. Prepare one panel for each type of sandblasting finish. Panels to be of similar material to the substrate being painted. Panels will be used as the comparison standard throughout the project.
 - .5 The Contractor must perform an adhesion test after proper cure to ASTM D4541 to demonstrate that the prime coat adheres to the substrate, and that the specified finish coatings adhere to the prime coat. Testing must be done on appropriately sized 6 mm thick coupons. Bonding strengths on the coupons must meet the minimum stated bond strength of the coating manufacturer. Suspect areas on the structure will be tested to fifty percent of the bond strength measured on the test coupon. Coupons must be prepared at the coating site under the same conditions as the equipment. The tests must be witnessed by the Independent Testing Agency. Where unacceptable test results are obtained, the Contractor must remove and reapply the specified coatings and retest at no expense to the Owner.
 - .6 The Contractor must prepare metallic surfaces in accordance with applicable portions of surface preparation specifications of the Steel Structures Painting Council (SSPC) specified in each coating system. Profile depth of surface to be coated to be twenty to twenty-five (20 to 25%) percent of the total dry film thickness as measured by Method C of ASTM D4417. Select blast particle size to produce the specified surface profile. The solvent in solvent cleaning operations to be recommended by the manufacturer.
 - .7 In testing for continuity of coating about welds, projections (such as bolts and nuts), and crevices, the Independent Testing Agency will determine the minimum conductivity for smooth areas of like coating where the dry film thickness has been accepted. This conductivity will then be taken as the minimum required for these rough or irregular areas. Pinholes and holidays are to be repainted to the required coverage.
 - .8 Provide the same access to the Independent Testing Agency as for painters. If necessary for safe inspection, provide scaffolding for use by the Independent Testing Agency.
 - .9 Notify the Engineer three weeks before commencing surface preparation and application of protective coatings in order to facilitate the inspection.
 - .10 Allow the Independent Testing Agency to inspect the coating during application with a wet mil gauge.
 - .11 After drying, allow the Independent Testing Agency to inspect with either the Elcometer, Microtest, Positest, Positector 6000 NF2, the Elcometer 256 Microprocessor-Digital DFT instruments, or other similar non-destructive test.
 - .12 The minimum dry film thickness at any point is not to be less than 80 percent of the required average for any spot reading and in accordance with SSPC – Good Painting Practice, whichever is more stringent.

- .13 Holiday inspection in accordance with NACE RP0188 must be done with the Tinker-Rasor Model-MI Wet Sponge Holiday Detector, or similar holiday test instrument, on film thicknesses from 25 - 325 microns (1-15 mils). Inspection of heavier film thicknesses (greater than 250 microns (10 mils) will be done with the Tinker-Rasor APW High Voltage Spark Detector or similar holiday test instrument. Confirm voltage setting with coating manufacturer to prevent damage.
- .14 All coatings must be holiday free. Holidays must be repaired and retested.
- .15 Calibrate all instruments at least hourly in the film thickness range of the coating being applied. Calibration shims will either be NBS calibration standards or KTA shims, whichever is applicable.

3.12 CLEANUP

- .1 Upon completion of coating, remove surplus materials, protective coverings, and accumulated rubbish, and thoroughly clean all surfaces and repair any overspray or other paint-related damage.
- .2 Do not dispose of solvents, cleaning solutions, thinners or extra paint on site. Store in sealed containers and remove from site to proper disposal, storage or recycling facilities.

3.13 COATING SYSTEM SPECIFICATION SHEETS (COATSPEC)

- .1 Coating systems for different types of surfaces and general service conditions for which these systems are normally applied are specified on the following COATSPEC sheets. In case of conflict between the finishing schedule and the COATSPECS, the requirements of the finishing schedule will prevail.
- .2 Coating System Identification: E-1
 - .1 Coating Material: Epoxy finish system
 - .2 Surface: Metals (excluding Stainless Steel)
 - .3 Service Condition: Non-immersion, interior exposure, covered and not exposed to direct sunlight including exterior surface of interior installed pipes as specified on the pipe data sheets.
 - .4 Surface Preparation:
 - .1 Shop Primed Surfaces: Prepare in the field by cleaning all surfaces in accordance with SSPC SP-1 (Solvent Cleaning). Clean damaged shop coating in accordance with SSPC SP-3 (Power Tool Cleaning) and repaint with the primer specified.
 - .2 Ferrous Metal (excluding Stainless Steel): Prepare bare ferrous metal surfaces in accordance with SSPC SP-6 (Commercial Blast Cleaning). Prepare bleeding surfaces in accordance with coating manufacturer's written recommendations.
 - .3 Non-ferrous Metal: Prepare in accordance with SSPC SP-1 (Solvent Cleaning).

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- .5 Prime Coating
 - .1 General: Apply one (1) coat of primer at manufacturer's recommended dry film thickness.
 - .2 Ferrous Metal (excluding Stainless Steel): The primer coat is to be an epoxy primer compatible with specified epoxy finish coats and applied in accordance with coating manufacturer's written recommendations.
 - .3 Non-ferrous Metal: Prepare in accordance with SP-7 (light uniform brush blast) or if recommended by coating manufacturer paint with a vinyl acid wash coat prior to the application of the prime coat.
 - .6 Finish Coating
 - .1 Apply one (1) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness – Not required if only one coat is needed.
 - .7 System Thickness: 125 – 200 microns (5 – 8 mils) total dry film thickness.
 - .3 Coating System Identification: E-2a
 - .1 Coating Material: Epoxy finish system.
 - .2 Surface: Metals (excluding Stainless Steel) used for fabrication of equipment as required in the specifications. Used for internal coatings on piping as specified on the pipe data sheets.
 - .3 Service Condition: Submerged.
 - .4 Surface Preparation:
 - .1 Remove oil and grease before mechanical cleaning is started in accordance with SSPC-SP1 (Solvent Cleaning).
 - .2 Ferrous Metal (excluding Stainless Steel): Prepare surfaces in accordance with SSPC SP-5 (White Metal Blast Cleaning). Blast profile to a minimum surface roughness of 1.5 – 2.5 mils or as specified by the coating manufacturer.
 - .3 Non-ferrous Metal: Prepare surfaces in accordance with SSPC SP-1 (Solvent Cleaning).
 - .5 Prime Coating
 - .1 General: Apply one (1) coat at manufacturer's recommended dry film thickness.
 - .2 Ferrous Metal (excluding Stainless Steel): The primer coat is to be compatible with specified finish coat.
 - .3 Non-ferrous Metal: Prepare in accordance with SP-7 (light uniform brush blast) or if recommended by coating manufacturer paint with a vinyl acid wash coat prior to the application of the prime coat. Do not paint submerged non-ferrous metal.
 - .6 Finish Coating

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- .1 The finish coating must be a polyamide cured epoxy or modified phenolic epoxy. The minimum solids volume must be seventy (70%) percent. Apply two or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .7 System Thickness: 275 – 375 microns (11 – 15 mils) total dry film thickness.
 - .4 Coating System Identification: E-2b
 - .1 Coating Material: Epoxy finish coating.
 - .2 Surface: Metals (excluding Stainless Steel) used for used for fabrication of equipment, such as drives, macerators, effluent strainers, as required in the specifications.
 - .3 Service Condition: Splash zone.
 - .4 Surface Preparation:
 - .1 Remove oil and grease before mechanical cleaning is started in accordance with SSPC SP-1 (Solvent Cleaning).
 - .2 Ferrous Metal (excluding Stainless Steel): Prepare surfaces in accordance with SSPC SP-5 (White Metal Blast Cleaning). Blast profile to a minimum surface roughness of 1.5 – 2.5 mils or as specified by the coating manufacturer.
 - .3 Non-ferrous Metal: Prepare surfaces in accordance with SSPC SP-1 (Solvent Cleaning).
 - .5 Prime Coating
 - .1 General: Apply one (1) coat at manufacturer's recommended dry film thickness.
 - .2 Ferrous Metal (excluding Stainless Steel): The primer coat must be an inorganic zinc-rich coating containing eighty (80%) percent metallic zinc by weight in the applied dry film unless a written request for using organic zinc- rich coat is made. Touch up is always made using an organic zinc-rich coat. The primer coat is to be compatible with the specified finish coat.
 - .3 Non-ferrous Metal: Prepare in accordance with SP-7 (light uniform brush blast) or if recommended by coating manufacturer paint with a vinyl acid wash coat prior to the application of the prime coat.
 - .6 Finish Coating
 - .1 The paint must be an epoxy. Apply two (2) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .7 System Thickness: 250 – 325 microns (10 – 13 mils) total dry film thickness.
 - .5 Coating System Identification: E-2c (F7 Finish this contract shop applied)

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- .1 Coating Material: Epoxy finish coating.
 - .2 Surface: Metals (excluding Stainless Steel) used for fabrication of equipment or structures in the Headworks, Fermenter, Centrifuge, Chemical storage and Compost Areas (presence of H₂S in the air).
 - .3 Service Condition: Splash zone or steel roof structures not easily accessible for repairs.
 - .4 Surface Preparation:
 - .1 Remove oil and grease before mechanical cleaning is started in accordance with SSPC SP-1 (Solvent Cleaning).
 - .2 Ferrous Metal (excluding Stainless Steel): Prepare surfaces in accordance with SSPC SP-5 (White Metal Blast Cleaning). Prepare Structural Steel surfaces to SSPC SP-10 (Near-white blast cleaning), or as recommended by the coating manufacturer. Blast profile to a minimum surface roughness of 1.5 – 2.5 mils or as specified by the coating manufacturer
 - .3 Non-ferrous Metal: Prepare surfaces in accordance with SSPC SP-1 (Solvent Cleaning).
 - .5 Prime Coating:
 - .1 General: Apply one (1) coat at manufacturer's recommended dry film thickness.
 - .2 Ferrous Metal (excluding Stainless Steel): The primer coat is to be compatible with specified finish coat.
 - .3 Non-ferrous Metal: Prepare in accordance with SP-7 (light uniform brush blast) or if recommended by coating manufacturer paint with a vinyl acid wash coat prior to the application of the prime coat. Do not paint submerged non-ferrous metal.
 - .6 Finish Coating:
 - .1 The paint must be an epoxy. Apply two (2) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .7 System Thickness: minimum 325 microns (minimum 10 mils) total dry film thickness
- .6 Coating System Identification: HH-1
- .1 Coating Material: Inorganic zinc.
 - .2 Surface: Ferrous metal (not insulated) such as diesel generator sets, boiler stacks, etc.
 - .3 Service Condition: Temperature up to 400°C. Confirm actual service conditions with coating manufacturer.
 - .4 Application: Field.
 - .5 Surface Preparation:

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- .1 Prepare metal surfaces in accordance with SSPC SP-10 (Near White Metal Blast Cleaning). Blast profile to a minimum surface roughness of 1.5 mils or as specified by the coating manufacturer.
 - .6 Prime Coating:
 - .1 Coating: One (1) or more coats at manufacturer's recommended dry film thickness per coat to the specified thickness.
 - .7 Finish Coating:
 - .1 Coating: One (1) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .8 System Thickness: 63-100 microns (2.5 - 4.0 mils) total dry film thickness.
 - .7 Coating System Identification: L-1
 - .1 Coating Material: Latex – Semi-gloss.
 - .2 Surfaces: Concrete, masonry, plaster, and gypsum board.
 - .3 Service Condition: Interior.
 - .4 Application: Field
 - .1 General: Sealer or filler to be dry a minimum of forty-eight (48) hours prior to primer application. Drying time between coats to be as recommended by coating manufacturer.
 - .5 Surface Preparation:
 - .1 Concrete: Allow concrete to age for at least twenty-eight (28) days and dry to the maximum moisture content recommended by the coating manufacturer.
 - .1 The Engineer may test moisture content with a Delmhorst Instrument Company moisture detector. Except as otherwise specified, remove all loose concrete, dirt, dust, efflorescence, form oils, surface hardeners, curing compounds, and laitance from surfaces and repair voids and cracks as recommended in Section 03300 prior to application of coatings. Neutralize all free lime by either completely drying out surface or by washing and painting with a zinc sulphate solution.
 - .6 Masonry: Allow aging for at least twenty-eight (28) days. Fill holes or other joint defects with mortar and re-point. Loose or splattered mortar to be removed by scrapping and chipping. Clean masonry surfaces with potable water by washing and scrubbing to remove foreign and deleterious substances. Do not use muriatic acid. After cleaning, masonry surfaces to be sealed or filled with sealer or block filler compatible with the specified primer.
 - .7 Plaster: Surfaces to be dry and clean and free from grit, loose plaster, and surface irregularities. Repair cracks and holes with acceptable patching materials, keyed to existing surfaces, and sandpapered smooth. Clean surfaces with potable water by washing and scrubbing to remove

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- foreign and deleterious substances. After cleaning, seal surfaces with a compatible sealer.
- .8 Gypsum Wallboard: tape joints and spackled nail heads to be sanded smooth and dusted. Seal with PVA sealer.
 - .9 Prime Coating:
 - .1 Apply one (1) coat at manufacturer's recommended dry film thickness.
 - .10 Finish Coating:
 - .1 Apply two (2) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .11 System Thickness: 25 – 50 microns (1 - 2 mils) total dry film thickness, excluding primer and sealer.
- .8 Coating System Identification: L-2
- .1 Coating Material: Latex.
 - .2 Surface: PVC and CPVC pipe.
 - .3 Service Condition: Exterior, direct sunlight exposure.
 - .4 Application: Field.
 - .5 Surface Preparation:
 - .1 Clean with solvent compatible with the specified PVC tested primer and sand to roughen surfaces.
 - .6 Prime Coating
 - .1 Apply one (1) coat at manufacturer's recommended dry film thickness.
 - .7 Finish Coating
 - .1 Apply one (1) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .8 System Thickness: 63 – 90 microns (2.5 – 3.5 mils) total dry film thickness
- .9 Coating System Identification: L-3
- .1 Coating Material: Latex.
 - .2 Surface: Metal.
 - .3 Service Condition: Interior.
 - .4 Application: Field.
 - .5 Surface Preparation:
 - .1 Shop primed surfaces: Prepare in the field by cleaning all surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning).
 - .2 Ferrous Metal: Prepare bare ferrous metal surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning). Clean bleeding surfaces in accordance with SSPC SP-1 (Solvent Cleaning) and seal with two (2) coats of sealer recommended by coating manufacturer,

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- applied to a thickness of 25 microns per coat prior to application of the prime coat.
- .3 Non-ferrous and Galvanized Metal: Prepare in accordance with SSPC SP-1 (Solvent Cleaning) treated with a passivator or otherwise as recommended by the coating manufacturer.
 - .6 Prime Coating:
 - .1 Apply one (1) coat at manufacturer's recommended dry film thickness.
 - .7 Finish Coating:
 - .1 Apply two (2) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .8 System Thickness: 125- 175 microns (5 – 7 mils) total dry film thickness excluding sealer.
 - .10 Coating System Identification: U-1
 - .1 Coating Material: Urethane finish coating.
 - .2 Surface: Ferrous metal.
 - .3 Service Condition: Exterior, exposed to direct sunlight.
 - .4 Surface Preparation:
 - .1 Remove oil and grease before mechanical cleaning is started in accordance with SSPC SP-1 (Solvent Cleaning).
 - .2 Ferrous Metal: Prepare bare ferrous metal surfaces in accordance with SSPC SP-6 (Commercial Blast Cleaning) or as recommended by the coating manufacturer if their requirement is more stringent.
 - .3 Non-ferrous and Galvanized Metal: Prepare in accordance with SSPC SP-7 (light uniform brush blast).
 - .5 Prime Coating
 - .1 General: Apply one (1) coat at manufacturer's recommended dry film thickness. Prime coat may be thinned and applied as recommended by the coating manufacturer, provided the coating, as applied, complies with prevailing air pollution control regulations.
 - .2 Ferrous Metal: Prime coats to be an epoxy primer compatible for use with urethane finish coats and applied in accordance with written instructions of the coating system manufacturer.
 - .3 Non-ferrous and Galvanized Metal: Paint with a vinyl acid wash coat prior to the application of the prime coat and in accordance with the manufacturer's written recommendations.
 - .6 Finish Coating
 - .1 Apply finish coat at manufacturer's recommended dry film thickness per coat to the specified system thickness.

- .7 System Thickness 75 – 125 microns (3 - 5 mils) total dry film thickness of epoxy and 50– 100 microns (2 – 4 mils) total dry film thickness of urethane.
- .11 Coating System Identification: U-2
 - .1 Coating Material: Urethane finish coating.
 - .2 Surface: Over existing coating, ferrous metal.
 - .3 Service condition: Exterior, exposed to direct sunlight.
 - .4 Surface Preparation:
 - .1 Clean damaged shop coated areas in accordance with SSPC SP-3 (Power Tool Cleaning) and repaint with the primer specified.
 - .2 Ferrous Metal: Clean coated ferrous metal surfaces in accordance with SSPC SP-1 (Solvent Cleaning) and seal with two (2) coats of sealer recommended by coating manufacturer, applied to a thickness of 36 microns (1 mil) per coat prior to application of the prime coat. Blast profile to a minimum surface roughness of 1.5 – 2.5 mils or otherwise as specified by the coating manufacturer.
 - .3 Non-ferrous and Galvanized Metal: Prepare in accordance with coating manufacturer's recommendation.
 - .5 Prime Coating:
 - .1 General: Prior to application test to overcoat compatibility. Apply one (1) coat at manufacturer's recommended dry film thickness.
 - .6 Finish Coating:
 - .1 Apply one (1) or more coats at manufacturer's recommended dry film thickness per coat to the specified system thickness.
 - .7 System Thickness: 50 – 100 microns (2 – 4 mils) total dry film thickness of urethane.

3.14 FINISHING SCHEDULE

- .1 Specific coating systems, colours, and finishes for rooms, tunnels, piping, equipment, and other items which are coated or have other architectural finishes are shown on the drawings, individual specification sections or specified in the following coating system schedule. Unless otherwise specified in the coating system schedule, the word "interior" means the inside of a building or structure, and the word "exterior" means outside exposure to weather elements. Final colours will be selected during construction based on the sample colour chart submittal.

Surface/Location		Coating System Identification	Colour
Headworks			
1	Ferrous Metal, excluding Stainless Steel	E2-c	Black
2	Motor and Drive Mechanism, Atmospheric Environment	U1 or U-2	To match existing

3	Stainless Steel	Uncoated	N/A
4	Brass	Uncoated	N/A
5	FRP	Uncoated	N/A
6	Aluminum	Uncoated	N/A
Other Equipment and Metal Appurtenances			
1	Ferrous Metal, excluding Stainless Steel, Submerged	E2-a	Black
2	Ferrous Metal, excluding Stainless Steel, Splash Zone	E2-b	Black
3	Equipment, Motor and Drive Mechanism, Atmospheric Environment or Interior	U1 or U-2	Comparable to Safety Blue High Gloss
4	High temperature equipment operable at: 93 to 400C	HH-1	Coating Manufacturer's Standard Gray
5	Brass	Uncoated	N/A
6	FRP	Uncoated	N/A
7	Aluminum	Uncoated	N/A
8	Electrical indoor equipment enclosures including motor control centers, power transformers, distribution centers, variable frequency drive panels and motor control stations, unless noted otherwise	Refer to section TBD	Refer to section TBD
9	Instrumentation panels, graphic indicating panels, indicating and transmitting field panels, unless otherwise specified, interior and exterior	Refer to this specification	To be selected
Piping- Interior			
1	Ferrous, non-ferrous, galvanized piping, and appurtenant supports, unless otherwise specified.	Refer to section TBD	Refer to Section 40 05 40
3	Plastic Piping.	L-2	Refer to Section 40 05 40
4	Stainless Steel	Uncoated	
5	Rubber Flexible Expansion Joint	Uncoated	
6	FRP Piping	Uncoated	
Piping- Exterior			
1	Ferrous, non-ferrous, galvanized piping, and appurtenant supports, unless otherwise specified.	Refer to section TBD	Refer to Section 40 05 40
2	Plastic Piping.	L-2	Refer to Section 40 05 40
3	Stainless Steel	Uncoated	
4	Rubber Flexible Expansion Joint	Uncoated	
	FRP Piping	Uncoated	

5	Ferrous, non-ferrous, galvanized piping, and appurtenant supports, unless otherwise specified.	Refer to section TBD	Refer to Section 40 05 40
Piping- Below Grade			
1	Ferrous, non-ferrous, galvanized piping, and appurtenant supports, unless otherwise specified.	Refer to section TBD	Refer to end of this Section
2	Rubber Flexible Expansion Joint	Uncoated	
3	FRP Piping	Uncoated	
Valves (including handles)			
1	Control and speciality valves, including actuators	Shop applied manufacturer's coating system	To manufacturer's requirements
2	Manual shut-off and check valves	U	Refer to Section 40 05 40
Concrete, Grout, Masonry and Plaster			
1	Unlined, submerged tank and channel wall and bottoms common with dry area or room, unless otherwise specified	Uncoated	
2	Outside concrete wall below grade common with dry area or room, unless waterproofed or otherwise specified	Uncoated	
3	Floors, wall and ceilings, unless otherwise specified:	L-1	White
4	General Floor Treatment: Tunnels, galleries, etc., unless otherwise specified - F3 Finish.	Refer to Division 33	N/A
Handrails Gratings, Floor Plates, Hatches			
1	Aluminum interior and exterior otherwise specified	Uncoated	
Steel Stairs, Ladders, Platforms, and Supports			
1	Interior	Refer to mechanical sections	To be selected
2	Exterior	Galvanized	N/A
Aluminum Flashing, Light Standards, and Supports			
1	Interior	Uncoated	
2	Exterior	Uncoated	
Other			
1	Fire Hydrants	N/A	
2	Slide Gates and Level Control Gates	Uncoated	
3	Tanks: 1. Steel tanks, Exterior	U-1	White
4	Plastic, rubber, including flexible hose, conduit and plastic coated tubing, in areas not exposed to view	Uncoated unless in corrosive	To be selected

		environment; then U-2	
5	Buried, sleeve-type and flanged pipe, couplings, valves, mechanical and electrical penetrations:	Refer to mechanical sections	To be selected
6	Pipe racks, aluminium, galvanized	Uncoated	
7	Pipe Rails (UV outfall tie-in)	U-1	Blaze Orange
8	New Doors and Frames, interior	Section 09901	To be selected
9	New Doors and Frames, exterior	Section 09901	To be selected
10	Structural Steel (F7 finish)	E2-c	Light grey

3.15 COLOUR CODING

- .1 Refer to Section 40 05 40 for identification colours.

3.16 SPARE PAINT

- .1 Provide one gallon of all types of finish coatings and colour schedules for touch up purposes.

END OF SECTION

1.1 General

1.2 WORK INCLUDED

- .1 Identification of equipment, motors, vessels, valves, ferrous, non-ferrous, and insulated piping.

1.3 SUBMITTALS

- .1 Submit list of plates for review prior to engraving.
- .2 Submit colour board for approval, a minimum of three (3) weeks prior to painting.

PART 2 PRODUCTS

2.1 Equipment Nameplates

- .1 Provide metal equipment nameplates on each piece of manufacturer's equipment, mechanically fastened, with raised or recessed letters.
- .2 Provide Underwriters' Laboratories and/or CSA registration plates, as required by respective agency.
- .3 Provide manufacturer's nameplates indicating size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 Equipment - Project Identification

- .1 Supply and install black laminated identification plates with 12 mm high white letters on all equipment installed under this contract. Include the unit name and tag number.

2.3 Valving

- .1 Provide all valves with a 32 mm diameter brass tag with 12 mm black engraved numbers complete with non-ferrous chains or 'S' hooks.
- .2 Consecutively number valves in distinct systems in accordance with piping and instrumentation drawings.
- .3 Furnish a directory consisting of a typewritten valve list showing the tag number, valve location, and its use. The directory may be made up in sections to suit the respective plant area or system.

2.4 Piping

- .1 Paint all piping installed under this Contract, with identifying pipe markers designating the pipe service and the direction of flow, except for stainless steel pipe and aluminum recovered pipe which must be banded and identified.
- .2 Either paint or self adhesive decals are acceptable pipe markers.
- .3 Direction arrows are to be 150 mm long by 70 mm wide for piping with an outer diameter 75 mm or larger, including insulation. Use 100 mm long by 20 mm wide for smaller diameters. Abbreviations for names of the pipe service are provided in the drawings.

2.5 Colour Coding

- .1 Apply the colour coded system identification on the following items:
 - .1 All uninsulated piping and valves.
 - .2 All canvas and cotton insulated coverings.
 - .3 All pumps - coat pumps with the colour identifying the material being pumped.
 - .4 Paint all motors blue.
- .2 Identification consists of the following:
 - .1 Full coating of non-stainless steel pipes and valves to the colour designated for the commodities being conveyed.
 - .2 Coat non-submerged process equipment to match the colour code of the material being processed.
 - .3 Paint valve handles, chain wheels, and similar appurtenances black.
- .3 Identification colours must be as directed by the Engineer and must match existing, whenever possible. For factory finished equipment, the identification colours must be identified by the Engineer during the shop drawing submission stage.
- .4 Piping, ductwork, conduit and support identification colours and description must match the following schedule. Colours not indicated in the table must be confirmed with the Engineer.

.5

Line Description/ Legend	Abbreviation	Line Colour	Band Colour
DAF SUBNATANT	DSUB	Dark Blue	-
DEWATERED SLUDGE	DWS	N/A since Stainless Steel	
DOMESTIC COLD WATER (POTABLE)	DCW	Blue	-
FINAL EFFLUENT	FE	White	2 medium green bands
GLYCOL RETURN	GLR	Dark Grey 28-F-15	-
GLYCOL SUPPLY	GLS	Dark Grey 28-F-15	-
GRIT	GR	"Oxide Yellow"	-
HAULED SCREENED SEPTAGE	HSS	Brown	-
INSTRUMENT AIR	IA	White	1 black band
LUBE OIL	LO	Blue 28-B-5	1 yellow band
MIXED LIQUOR	ML	Charcoal	-
NATURAL GAS	NG	Yellow	Black
NON-POTABLE PLANT WATER	NPW		
NON-POTABLE PLANT WATER (HOT)	NPWH		
POLYMER	POLY	"Foam Green"	-
PRIMARY EFFLUENT	PE	Brown	White
PROCESS AIR	PA	N/A since Stainless Steel	-
PROCESS WASTE DRAIN	DR	Black	
RAW HAULED SEPTAGE	RHS	N/A since Stainless Steel	-
RAW SEWAGE	RS	Brown	-
SANITARY SEWER	SAN	Black	-
SCREENED RAW SEWAGE	SRS		
SECONDARY EFFLUENT	SE	Grey	-
THICKENED WASTE ACTIVATED SLUDGE	TWAS	Dark Blue	-
PROCESS AIR	PA	White	1 Black band
WASTE ACTIVATED SLUDGE	WAS	Grey	-
PROCESS EQUIPMENT	-	Blue	-
ELECTRICAL DUCTS / CONDUITS	-	Purple	-
SUPPORTS	-	Black	-

PART 3 EXECUTION

3.1 Nameplates

- .1 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.2 Fasteners

- .1 Attach plates to the equipment with sheet metal screws or nuts and bolts (adhesive is not acceptable).
- .2 Fasten plates in conspicuous locations. On hot or cold surfaces where plates cannot be mounted, provide standoffs.

3.3 Piping

- .1 On completion of protective coatings or finish painting, neatly stencil on yellow, green or white backgrounds, as appropriate, directional flow arrows and the pipe service or attach pipe marking labels.
- .2 Provide pipe identification in readily visible locations. Identify pipes at each of the following locations:
 - .1 At each valve
 - .2 On both sides of wall penetrations
 - .3 At floor and roof penetrations
 - .4 On each leg of branches
 - .5 Every 6 m along continuous runs of natural gas, as per code.
 - .6 Every 10 m along continuous runs for all other pipes.

END OF SECTION

PART 1 GENERAL

1.1 Description

- 1.1.1 Alternating current induction motors, 150 kW or less, NEMA Frame type.
- 1.1.2 Unless specified otherwise, electric motors to be provided by the Manufacturer of the driven equipment, as an integral component of the driven equipment, as specified in Section 40 05 00.
- 1.1.3 Motors suitable for starting, accelerating, and running centrifugal pumps, fans, blowers, compressors, gear driven equipment or other loads started and controlled via across the line starters, reduced voltage starters, soft starters or variable frequency drive as noted in the equipment data sheets.

1.2 Reference Standards

- 1.2.1 Conform to latest revision of the following reference standards:
 - .1 ANSI/ABMA 11, Load Ratings and Fatigue Life for Roller Bearings.
 - .2 CSA C22.2 No. 100, Motors and Generators.
 - .3 CSA C22.2 No. 145, Motors and Generators for Use in Hazardous Locations.
 - .4 CSA C390, Energy Efficient Test Methods for Three Phase Induction Motors.
 - .5 IEEE 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
 - .6 IEEE 114, Standard Test Procedures for Single-Phase Induction Motors.
 - .7 IEEE 841, Standard for Petroleum and Chemical Industry – Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors, Up to and including 500 hp (370 kW).
 - .8 NEMA MG1, Motors and Generators.
 - .9 Statutes of Canada, Energy Efficiency Act, 1992
 - .10 Statutes of Canada, Energy Efficiency Regulations
 - .11 Underwriters Laboratory (UL): 674, Electric Motors and Generators Used in hazardous (Classified) Locations.

1.3 Submittals

- 1.3.1 Shop Drawings: Submit with the related items of equipment in accordance with Section 01 33 00 - Submittal Procedures and Section 40 05 00 - General Process Provisions. In addition, submit the following details: Provide the specified information for each type and size of motor for all motor driven equipment. The motor data should be updated according the elevation of the equipment installation location.
 - .1 Overall dimensions of motor.
 - .2 Complete motor nameplate data, as defined by NEMA, and motor manufacturer, including any motor specifications.

- .3 Provide following information on motor: Serial #, Voltage, Amps, Speed (RPM), Phase, Hz, Insul Class, Amb Temp, SF, Frame Size, Encl, Code, Rating, Design, Weight (kg), Type, Efficiency (nominal), Efficiency (minimum), Power factor
- .4 Shaft centreline to base dimension.
- .5 Shaft extension diameter and keyway, coupling dimensions and details.
- .6 Fixing support dimensions.
- .7 Terminal box location and size of terminals. Including sealing arrangements.
- .8 Methods of connection to driven equipment.
- .9 Arrangement and dimensions of accessories.
- .10 Motor wiring connection diagram.
- .11 Speed/torque characteristic.
- .12 Motor temperature monitoring devices
- .13 Voltage and amperage draws upon startup
- .14 Weight of motor
- .15 Installation data.
- .16 Rotation direction.
- .17 Starting restrictions (time between starts).
- .18 Terminal leads marking.
- .19 Bearing data (including part numbers).
- .20 Recommended lubricant.
- .21 Design ambient temperature and temperature rise ratings.
- .22 Torque characteristics including rated starting torque and breakdown torque.
- .23 The ABMA L-10 rated life for the motor bearings.
- .24 The nominal efficiency for all motors at 100 percent, 75 percent, and 50 percent of load.
- .25 Service rating of motor showing class, division, group and UL frame temperature limit code for explosion-proof motors.

1.4 Operating and Maintenance Data

- 1.4.1 Provide all information to be incorporated into the operation and maintenance manual as specified in Section 01 78 00 Closeout Submittals. Include the following, in addition to that information specified in Section 01 66 00 - Common Product Requirements and the specific information listed for various equipment items in the specific specifications:
 - .1 Complete description of operation and maintenance procedures and requirements including manufacturer's recommended maintenance schedule.
 - .2 Diagrams and tables illustrating speed/torque characteristics for installed motor.

- .3 General arrangement and detailed drawings.
- .4 Lifting instructions.
- .5 Wiring diagrams for power and control schematics.
- .6 Parts catalogues with complete list of repair and replacement parts with section drawings, illustrating the connection and the parts manufacturer's identifying numbers.

1.5 Service Conditions

- 1.5.1 Unless specified otherwise, provide motors suitable for continuous operation at an elevation of 1000 to 1100 meters above sea level.
- 1.5.2 Provide motors suitable for continuous operation in a 40°C ambient temperature.

1.6 Coordination

- 1.6.1 Motors fed via reduced voltage starters, soft starters or variable frequency drives, to be inverter duty rated and suitable for the intended application. State any motor limitations for VFD applications. Comply with drive requirements of the starter manufacturer.

1.7 Quality Assurance

- 1.7.1 Build motors in accordance with CSA C22.2 No. 100, CSA C22.2 No. 145, NEMA Standard MG1, IEEE 841 and to the requirements specified in this Section.

1.8 Shipment, Protection and Storage

- 1.8.1 Refer to the general provisions in Section 01 61 00 Common Product Requirements and Section 40 05 13 - General Process Provisions.
- 1.8.2 Ship, protect and store equipment in a manner that prevents damage or premature aging.
- 1.8.3 Protect motors from moisture, condensation and dust during shipping, storage and installation.
- 1.8.4 Handle motors with suitable lifting equipment.
- 1.8.5 Store motors in heated, dry, weather-protected enclosure.

PART 2 PRODUCTS

2.1 Acceptable Manufacturers

- 2.1.1 Baldor - Reliance
- 2.1.2 GEC Alsthom
- 2.1.3 Siemens
- 2.1.4 WEG
- 2.1.5 Toshiba
- 2.1.6 U.S. Motors

2.1.7 TECO - Westinghouse

2.2 Materials

2.2.1 Motors: to CSA C22.2 and NEMA MG-1.

2.2.2 Lead markings: to CSA C22.2.

2.2.3 Unless specified otherwise, provide all motors with:

.1	Frame	Cast iron, steel, or cast aluminum
.2	Endplates	Cast iron or cast aluminum
.3	Terminal boxes	Cast iron, steel, or cast aluminum
.4	Fan blades and shrouds	Non-metallic, corrosion resistant
.5	Hardware	Stainless steel
.6	Windings	Copper, with non-hygroscopic insulation

2.3 Motor Efficiency

2.3.1 Use premium efficiency motors with efficiencies that comply with the minimum requirements of NEMA MG-1, Table 12-10.

2.3.2 Use vertical motors with efficiency within 0.5 percent of minimum values stated for horizontal motors.

2.3.3 Test motor efficiency in accordance with CSA C390 and NEMA MG1, accounting for stray load losses, measured indirectly based on the IEEE method.

2.3.4 Stamp full load efficiency on the motor nameplate.

2.4 Horizontal and Vertical Motors, 0.56 kW to 150 kW

2.4.1 General

- .1 Unless otherwise specified, motors 0.56 kW to 150 kW to be 3-phase, squirrel cage induction type, full voltage start, high efficiency, and with copper windings.
- .2 Service factor of 1.15 at 40°C ambient.
- .3 Rated for 575 V/3Ø /60Hz service unless otherwise specified.
- .4 Design motors for full voltage starting, capable of running successfully when terminal voltage is from +10 percent to –10 percent of nameplate voltage and terminal frequency is from + 5 percent to – 5 percent of nameplate frequency.
- .5 Size motor with sufficient capacity to operate the driven load and associated devices without overloading under all operating conditions.
- .6 Design motor so that it is able to be re-started after an immediate trip, after coasting to rest; and subsequently at an interval defined below.
- .7 Minimum intervals for subsequent restart are as follows:

0.56 to 7.5 kW	15 minutes
7.5 to 37.5 kW	30 minutes
37.5 to 150 kW	60 minutes

2.4.2 Torque Requirements

- .1 Provide motors capable of developing 150 percent of NEMA Design B locked rotor and pull-up torques with 100 percent of rated voltage applied and capable of developing in excess of NEMA locked rotor torque values at 90 percent of rated voltage.

2.4.3 Inertia Loading

- .1 Design motors to be capable of 200 percent of inertia loading values indicated in MG1-12.50, Table 12.3.

2.4.4 Insulation

- .1 Minimum Class F insulation
- .2 Design motor for temperature rise up to 90°C at 1.15 service factor loading.
- .3 Insulation to be non-hygroscopic.

2.4.5 Varnish

- .1 Dip and bake in Class H varnish a minimum of 2 times. For 284T and larger frames, dip and bake a minimum of 3 times.

2.4.6 Current Imbalance

- .1 Do not exceed the values tabulated below when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system:
 - Under 37.5 kW: 15 percent
 - 37.5 kW and above: 10 percent
- .2 Base imbalance criteria upon the lowest phase value measured.

2.4.7 Winding Over-temperature Protection

- .1 Provide stator winding over-temperature protection on all motors rated 45 kW and larger. Motors rated less than 45 kW to have stator winding over-temperature protection when specified or if recommended by the driven equipment Manufacturer.
- .2 Over-temperature protection for motors rated 45 kW and larger and other motors, where specified, to be NEMA MG1-12.53, Type 1, winding running and locked rotor over-temperature protection. Detectors to be positive thermal protection (PTC) thermistor type, with leads brought out to a terminal strip in a NEMA 4 enclosure in Type 2 motors and a NEMA 7C or 9 enclosures for Type 3 motors. Provide a minimum of one detector per phase.

2.4.8 Bearings

- .1 Select type of bearings on basis of torque and thrust requirements.
- .2 Provide anti-friction bearings with grease lubrication, capable of one-year continuous operation without regreasing.
- .3 Insulate bearings to prevent flow of circulating current through bearings.
- .4 Provide sealed ball or cylindrical roller bearing type on motors less than 37.5 kW.

- .5 Bearings on 37.5 kW motors or larger to be greasable ball bearing type, rated for a minimum L-10 life of 100,000 hours at the ambient temperature specified herein.
- .6 Design bearings to have a maximum 45°C temperature rise at rated horsepower for 4 pole and greater motors and 50°C for 2 pole motors.
- .7 Provide features to minimize the entrance of moisture and contaminants into the bearing chamber.
- .8 Provide insulating grease and grounding ring for all motors that are inverter duty.

2.4.9 Direction of Rotation

- .1 Design the motor so that it is capable of running in either direction of rotation by reconnecting the motor terminals.

2.4.10 Frame

- .1 Use a minimum of grade 25 cast iron, aluminum, or steel for frame, end brackets, fan cover, and conduit box. Refer to motor classifications.
- .2 Provide two bronze automatic breather drains at the lowest point in the motor frame.
- .3 On frames sizes greater than 180, provide removable lifting eyes at the balance point of the motor, with a design safety factor greater than 10. Vertical motors require two eyes, one on each side of the frame.
- .4 Use stainless steel hardware.

2.4.11 Motor Classifications:

- .1 Type 1 (General Duty): Unless specified otherwise, TEFC enclosures.
- .2 Process: TEFC or TENV, suitable for moist and corrosive environment. All internal surfaces to be coated with an epoxy paint.
- .3 Explosion-proof: XPFC enclosures for motors rated for operation in a Class 1, Zone 2 hazardous location in accordance with CSA C22.1. Provide an approved breather/drain device in the motor drain hole.
- .4 Exterior: TEFC or weather protected. All internal surfaces to be coated with an epoxy paint.

2.4.12 Cooling Fans

- .1 Fabricate external cooling fans of non sparking, corrosion resistant material.

2.4.13 Terminal Box

- .1 Incorporate an oversize terminal box with a volume greater than NEMA requirements, rotatable in 90° increments. Provide gaskets between the terminal box and frame and between the terminal box and cover.
- .2 Provide diagonally split, gasketed, NEMA 4 terminal boxes complete with threaded hub for conduit entry for ODP and TEFC motors and adequately sized, diagonally split, gasketed NEMA 7 terminal boxes complete with threaded hub for conduit entry for explosion-proof motors.

- .3 Provide a ground connection and lugs in the terminal box.
- .4 Provide a separate terminal box for all motors required to have internal monitoring devices connect wiring to terminal blocks.

2.4.14 Vibration and Critical Speed

- .1 Align and balance motors in the factory.
- .2 Measure displacement horizontally and vertically in accordance with CEMA Standard M1-20.58 and 20.59. Balance so that measured values are less than the following:

<u>Nominal Running Speed</u>	<u>Amplitude</u>
(rpm)	(mm)
3600	0.0125
1800	0.0175
1200 and under	0.025

- .3 Ensure that axial vibration, as measured at the bearing housings, does not exceed twice the above values.

2.4.15 Motors are to be aligned and balanced with the related equipment in the shop to minimize vibration and undue stresses. Maximum vibration of motor at the bearing housing is 12.5 microns peak to peak. As necessary, provide stainless steel balance washers.

2.4.16 Where not specified for items of equipment, motor sound pressure levels at 1.0 metres, free field:

- .1 90 kW and larger 2 pole motors 90 dBA
- .2 All other motors 85 dBA

2.4.17 Where specified, equip motors with anti-condensation heaters suitable for connection to 120 volts, single phase, 60 Hz.

2.5 Motors Smaller than 0.56 kW

2.5.1 General

- .1 Unless otherwise specified, motors 0.56 kW and smaller to be squirrel cage, single phase, capacitor start, induction run type with copper windings.
- .2 Construction features listed in this Section may be as normally supplied by the equipment Manufacturer.
- .3 Single phase motors to have Class F insulation.
- .4 Small fan motors may be split-phase or shaded pole type.
- .5 Provide copper windings.

2.5.2 Rating

- .1 Unless specified otherwise, motors to be rated for operation at 115/1/60 VAC, and continuous-time rated in conformance with NEMA Standard MG1, paragraph 10.35.

2.5.3 Enclosures

- .1 Unless otherwise specified, provide motors with totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) enclosures.
- .2 Provide motors rated for the area, bearing the CSA or ULC label.
- .3 Provide an over-temperature device in the enclosure to detect and automatically de-energize the motor.

2.6 Motors for Variable Frequency Drives

2.6.1 Comply with the characteristics of the intended variable frequency drives. Ensure that the variable frequency drives are rated for 600 Volts/3 phase/60 Hz service.

2.6.2 Select premium efficiency units, inverter duty rated, CSA certified to be in conformance with NEMA MG1, Part 30 and Part 31.

2.6.3 Design to ensure turndown of a minimum of 5:1 unless specified elsewhere.

2.6.4 Provide motors rated for the area, bearing the CSA or ULC label. Insulation: Minimum Class F insulation, suitable for 90°C temperature rise, with a 1.15 safety factor, suitable for moist and corrosive environments and in accordance with NEMA MG1 Part 30 and Part 31. Provide additional treatment at winding end turns to minimize stray current failures.

2.6.5 Design motors for variable frequency systems so that they are not required to deliver more than 90 percent of the motor's power rating when the load of the driven machine is at any specified operating condition or any condition imposed by the driven machine's performance curve at maximum operating speed.

2.6.6 Ensure motors have adequate cooling capacity when operating through the entire speed range capacity of the drive. Provide over-sized fans where required to provide that cooling.

2.6.7 Enclosure and other insulation requirements are the same as required for constant speed motors.

2.6.8 Provide wave traps at the motor for all motors located more than 50 m from the associated drive.

2.7 Vertical Motors

2.7.1 Unless otherwise specified, provide full voltage vertical motors with a Type P base specifically designed for vertical installation.

2.7.2 Universal position motors are not acceptable.

2.7.3 Provide vertical motors with solid shafts unless specified otherwise.

2.7.4 Provide thrust bearing rating compatible with the loads imposed by the driven equipment.

2.8 Two Speed Motors

- 2.8.1 Provide two speed motors with separate windings. Single winding two speed motors are not acceptable.

2.9 Power Factor Correction Capacitor Sizing

- 2.9.1 The motor vendor to confirm the maximum capacitor size which may be connected to motors 7.5 kW and larger to correct the power factor to 95 at rated speed.

2.10 Motor Mounting

- .1 Where equipment is specified to include C-Flange mounting, make motors compatible with this joining and alignment technique.
- .2 End-bell mounted bearings: Provide motor sole plates, machined top and bottom, with a minimum thickness of 50 mm depending upon motor size.
- .3 Pedestal type, independent of stator frame: Provide fabricated structural steel base, suitably braced to prevent distortion, to mount the stator frame and the bearing pedestals.
- .4 Provide vertically mounted motors with drip shield.

2.11 Finishes

- 2.11.1 Exterior of motor, factory prime and paint in accordance with Section 40 05 30 – Process Piping and Coating Systems.
- 2.11.2 On interior of motor, apply rust inhibiting coating on all exposed machined surfaces.

2.12 Equipment Identification

- 2.12.1 Provide equipment identification in accordance with Section 40 05 40 – Process Identification.
- 2.12.2 Nameplates
- .1 Provide motor nameplates on engraved or stamped stainless steel. Include motor data in accordance with NEMA Standard MG1, paragraph 10.37, 10.38 or 20.60, as applicable. Permanently fasten nameplates to the motor frame and position so they are visible.
 - .2 Indicate the ABMA L-10 rated life for the motor bearings for motors 37.5 kW and larger.
 - .3 Indicate the nominal efficiency for all motors.
 - .4 Indicate class, division, group and CSA/ULC frame temperature limit code for explosion-proof motors.
 - .5 Permanently fasten nameplates to the motor frame and position to be easily visible for inspection.

2.13 Spare Parts

- 2.13.1 Provide maintenance materials and spare.

PART 3 EXECUTION

3.1 Installation

- 3.1.1 Ensure the motor is properly installed and aligned.
- 3.1.2 Provide lamacoid label with equipment tag to clearly identify the motor.
- 3.1.3 Make connections with liquid-tight PVC jacketed flexible conduit between rigid conduit and motor.
- 3.1.4 Make flexible conduit long enough to allow removal of the motor without disconnecting wiring.
- 3.1.5 Check for correct direction of rotation, with motor uncoupled from driven equipment.
- 3.1.6 Align and couple motor to driven machinery using parts such as couplings, belts, sheaves, as recommended by the Manufacturer.
- 3.1.7 Install anchor devices or base templates in accordance with requirements of Manufacturer.

3.2 Demonstration and Operational Testing

- 3.2.1 Perform mechanical tests to ensure equipment is coupled and aligned properly.
- 3.2.2 Perform electrical tests by checking voltage and current draw on motor at load and compare to nameplate data in accordance with testing requirements outlined in Division 1 and Division 16.
- 3.2.3 Perform insulation resistance test (Megger) on motor as per Electrical Testing specifications.
- 3.2.4 For each item of equipment, attach test documentation to **Form 103** (Refer to Section 01 79 00).

END OF SECTION

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT

Part 1 General

1.1 SECTION INCLUDES

- .1 Requirements for supply, delivery, installation, and commissioning of the following, as required for complete and proper installation:
 - .1 Two (2) tank mounted shaftless spiral fine screening, washing, conveying and dewatering units (abbreviated name: fine screens), associated controls and all ancillary components for screening of raw wastewater. Supply the fine screens as one complete package from a single Manufacturer. Coordinate dimensions to ensure all equipment fits in the allocated space as indicated in the Drawings.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 – Common Product Requirements
- .3 Section 01 78 00 – Closeout Submittals
- .4 Section 01 79 00 – Demonstration and Training
- .5 Section 01 91 13 – General Commissioning Requirements
- .6 Section 40 05 00 – General Provisions Process
- .7 Section 40 05 13 – Process Piping
- .8 Section 40 05 13.01 – Detailed Process Piping
- .9 Section 40 05 23 – Process Valves
- .10 Section 40 05 30 – Process Piping and Coating Systems
- .11 Section 40 05 40 – Process Identification

1.3 REFERENCES

- .1 The electrical panels, instruments panels and related electrical and controls components for the fine screens are to be installed in the new Headworks Building and as such, are to be certified for installation in a Class 1, Zone 2 rated area.
- .2 All equipment to be CSA approved.
- .1 American Society for Testing and Materials International (ASTM International)

- .2 American Gear Manufacturers Association (AGMA)
- .3 American Iron and Steel Institute (AISI)
- .4 American Society of Mechanical Engineers (ASME)
- .5 American National Standards Institute (ANSI)
- .6 Institute of Electrical and Electronics Engineers (IEEE)
- .7 National Electrical Code (NEC)
- .8 National Electrical Manufacturer's Association (NEMA)
- .9 National Fire Protection Association (NFPA)
- .10 American Bearing Manufacturers Association (ABMA)
- .11 American Welding Society Code (WSC)
- .12 Underwriters Laboratory Standards (UL)

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 A copy of this section indicating conformance or acceptance of each clause. Non-conformance or variation must be indicated by a cross ('X').
 - .2 A Letter of Compliance, which confirms any variances with the Contract Plans and Specifications, and provides further explanations where necessary to adequately define the scope of supply.
 - .3 A documented report of the Screenings Capture Rate (SCR) / Efficiency (Percentage of all material captured by the screen as documented by the National screen evaluation facility at Chester Lee Street in England by TRPM and Northumbrian Water) must be provided with submittals.
- .2 Shop Drawings:
 - .4 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .5 Dimensional plan and section drawings of the equipment mounted in the structure, showing all utility connections and requirements, and anchor bolt locations. Where applicable, drawings will show connection to associated equipment provided by others.
 - .6 Approximate weight of each component or piece of equipment.

-
- .7 Manufacturers' catalog information, descriptive literature, specifications, and identifications of material of construction.
 - .8 Installation reference list.
 - .9 Power and control wiring diagrams, including terminal layout with numbers, panel construction and panel layout drawings, and control schematics diagrams. Control diagrams will also include a description of operation.
 - .10 Manufacturers' performance data for all drives.
 - .11 Gear reducer data including service, efficiency, torque, rating and materials of construction.
 - .12 Process equipment control philosophy, control system hardware details, I/O list and memory map with addresses for status and control variable points to be made available to Plant Control System (PCS) via communications link.
 - .13 List of spare parts to be furnished
 - .3 Operation and Maintenance Data:
 - .1 Supply maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Supply equipment operating instructions
 - .3 Supply equipment weights and lifting instructions
 - .4 Supply installation instructions
 - .5 Supply maintenance schedules
 - .6 Inform recommended lubricants
 - .7 Inform recommended spare parts including wear items
 - .8 Supply long-term and short-term storage instructions

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery:
 - .1 Deliver materials to the project in original, unopened packages and labeled to clearly identify product name and manufacturer.
 - .2 Items to be shipped as complete assemblies except where partial disassembly is required by transportation regulations or for protection of components.
 - .3 Wooden crates must not exceed 2.4 m in width x 2.4 m in height so that the equipment can be put in the headworks building utilizing the existing removable wall (2.4 m W x 2.4 m H).

- .4 Materials must be packaged to minimize or eliminate the possibility of damage during shipping.
- .5 Sequence deliveries to avoid delays, but minimize on site storage.
- .3 Storage and Handling:
 - .1 Store and handle in strict compliance with manufacturer's recommendations.
 - .2 All materials to be thoroughly inspected upon receipt and all discrepancies, deficiencies, and/or damages to be immediately reported, in writing, to the supplier.
 - .3 All damages incurred during shipment to be noted on the carrier's Bill of Lading and immediately reported, in writing, to the supplier.
 - .4 All materials to be properly stored on planks or dunnage, out of water and covered to protect from damage from any cause

1.6 QUALITY ASSURANCE

- .3 Contractor responsible for coordination and installation of products provided under this Section.
- .4 Furnish all equipment covered by this specification by one Manufacturer, and furnish complete with motor and appurtenances. Equipment to be supplied as a product from a single Manufacturer regularly engaged in the production of equipment for the specified use. The Manufacturer must have the sole responsibility for the proper functioning of the equipment as furnished.
- .5 The equipment will include all necessary safety devices, such as machinery guards, emergency stops, warning labels, and similar items.
- .6 The equipment must be factory assembled and tested for a minimum of four (4) hours at the factory prior to delivery to confirm fit and function of the fine screen. Certified results of the testing must be provided to the Engineer.
- .7 With submittals, report the Screenings Capture Rate (SCR) / Efficiency (Percentage of all material captured by the screen as documented by the National screen evaluation facility at Chester Lee Street in England by TRPM and Northumbrian Water).

1.7 WARRANTY

- .1 The manufacturer must warrant against any defects in material or workmanship to the equipment and coating for a period of 12 months from start-up.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 The fine screens (SCRN-01-210/SCRN-01-220) must screen raw wastewater prior to the treatment in the primary filters.
- .2 Screenings include rags, plastics, floatables and other debris present in raw sewage.
- .3 Provide fully automatic, self-cleaning fine screen units mounted in stainless steel tanks with semi-cylindrical, perforated plate media screen baskets. Screening units must be provided with an angle-of-inclination of 35° from horizontal.
- .4 The fine screens must be supplied in one piece requiring no field assembly. The fine screen manufacturer must take sole responsibility for the screen supplied.
- .5 Each fine screen unit must be provided with a fixed, semi-cylindrical screen basket, concentric shaftless spiral screw conveyor, screenings washing and screenings compaction zone with single motor drive system.
- .6 Equipment must be capable of presenting a clean filtration surface to the oncoming liquid stream at all times during operation.

2.2 CAPACITY AND PERFORMANCE REQUIREMENTS

- .1 The equipment must be sized for continuous operation (24 hour/day, 365 days/year) and for continuous raw wastewater screening.
- .2 The fine screens must be designed to operate within the design conditions specified herein:
 - .1 Annual Average Flow (current): 38.5 L/s
 - .2 Annual Average Flow (year 2041): 50.3 L/s
 - .3 Maximum Month Flow (current): 46.2 L/s
 - .4 Maximum Month Flow (year 2041): 60.4 L/s
 - .5 Peak Hour Flow (current): 115.5 L/s
 - .6 Peak Hour Flow (year 2041): 151 L/s
- .3 Each fine screen must be designed with capacity to treat 151 L/s of raw wastewater proceeding from the raw wastewater pumps.
- .4 The two (2) fine screens must operate in a duty/standby configuration.

2.3 ACCEPTABLE MANUFACTURERS

- .1 Enviro-Care
- .2 Veolia

.3 JWC

2.4 FINE SCREEN COMPONENTS

.1 General

- .1 Each fine screen must sufficiently be automated to require minimal operator attention.
- .2 Each filter unit must be freestanding and designed for installation on a platform to be located on the floor of the Headworks building. The platform will be supplied by others.
- .3 The fine screens must be installed in parallel with a separation of approximately 750 mm between the tanks as presented on the drawings.
- .4 The available space for installation of the fine screens in the upper floor of the Headworks building is very limited. The fine screen dimensions must be exactly as presented in the drawings. Files in CAD version of the drawings are being provided for verification.
- .5 The scope of supply for the fine screens and associated elements is presented in these technical specifications and in the preliminary PID provided with the RFQ.

.2 Each fine screen must be manufactured with the maximum following dimensions:

- .1 Tank length: 1990 mm
- .2 Tank width: 635 mm
- .3 Tank depth: 1370 mm

.3 The screenings discharge vertical height from the mounting floor must be 1540 mm

.4 The screen installation angle must be 35° from the horizontal.

.5 Each fine screen must be supplied with the following connections:

- .1 Influent flange size: 400 mm
- .2 Effluent flange size: 400 mm
- .3 Screenings discharge: 400 mm

.6 The maximum allowed upstream water level in the fine screens is to be 692 mm.

.7 The fine screen perforation size must be 6 mm.

.8 Materials

- .1 All wetted parts must be constructed from type 316L stainless steel except for the shaftless spiral.

-
- .2 The shaftless spiral must be constructed from a high strength alloy steel and supplied with a protective epoxy coating.
 - .3 All welds must be cleaned and passivated to remove weld spatter, slag and discoloration using glass bead blasting process.
 - .9 Tank Assembly
 - .1 The tank must be constructed from type 316L stainless steel. The tank must be designed to withstand the hydrostatic load from the process flow through the unit and provide support of the screenings basket area.
 - .2 The tank is to be supplied with footings for anchoring the unit, and lifting lugs for installation. The tank must be supplied with flanged inlet and flanged outlet connections.
 - .3 The tank must allow the screen to be pivoted to an angle parallel with the mounting floor for screen disassembling purposes.
 - .4 The top of the tank must be enclosed by type 316L stainless steel cover, including a hinged access door.
 - .5 A separate support stand must be constructed from type 316L stainless steel and provide support of the conveyor tube extension.
 - .6 Screen cover must be equipped with a safety limit switch installed to prevent the screen from operating with the tank cover in the open position. Screen cover must be supplied with connections for mounting the ultrasonic level sensor and vent connection.
 - .10 Screen Basket
 - .1 The screen basket must be fabricated from type 316L stainless steel perforated plate with a minimum thickness of 3 mm and designed and built to withstand the maximum possible static hydraulic forces exerted on the screen basket by the liquid flow. Structural and functional parts must be sized to prevent deflections or vibrations that may impair the screening, conveying and compacting operations.
 - .2 The screen basket must be of a semi-cylindrical shape with perforations around the entire basket.
 - .3 The screen basket must be perforated plate with maximum openings of 6 mm. Bar screens, wire mesh or wedgewire are not acceptable screen media.
 - .4 The screen basket must be cleaned by segmented nylon brushes attached to the screening basket zone of the shaftless spiral screw.
 - .5 The screen basket must incorporate rubber side seals in order to seal the screen basket to the tank wall to eliminate material bypass.

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- .6 The basket must be provided with a spray bar mounted near the top. Spray bar must system must be furnished with control solenoid valve, stainless steel piping and fittings, flexible reinforced hoses and 316L stainless steel spray nozzles.
 - .11 Spiral Screw Assembly
 - .1 The shaftless spiral screw assembly must be fabricated of epoxy coated high strength alloy steel with the following minimum dimensions:
 - .1 Basket Zone: spiral OD 205.7 mm, inner flight 6.3 mm, outer flight 6.3 mm, flight height 68.6 mm
 - .2 Transport Zone: spiral OD 190.5 mm, inner flight 19.8 mm, flight height 60.9 mm
 - .3 Units utilizing a shaft or tube in the spiral will not be accepted.
 - .2 The shaftless spiral screw assembly must be designed to clean the screening basket and transport material up the conveyor tube to the discharge of the unit.
 - .3 The shaftless spiral screw must be provided with individually replaceable brush segments in the screening basket zone. The individual brush segments must be UHMW backed nylon, mounted to the lower section of the spiral in 180° sections and held in place with stainless steel fasteners. Any unit incorporating a single, continuous brush, or brushes held in place with clips will not be acceptable.
 - .4 The unit must be provided with screw flights of constant pitch approaching the compaction zone. At the compaction zone, the flight pitch is to be reduced by two-thirds.
 - .5 At the compaction/dewatering zone, the shaftless spiral flights must end and transition to an integrated shafted dewatering section allowing for compaction of the screenings. At the discharge point the material must freely release out of the unit. To prevent material from wrapping around the shaft a serrated blade must be provided.
 - .12 Screenings Transport Zone
 - .1 The transport tube must be fabricated from type 316L stainless steel with a minimum thickness of 3 mm.
 - .2 The screenings transport tube must be provided with four (4) anti-rotation bars fabricated from type 316L stainless steel with a minimum thickness of 8 mm bolted to the inside along the longitudinal axis.

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- .3 The screen basket must be attached via a support flange to the screenings transport tube by a conical transition section. The support flange must have a minimum thickness of 8 mm.
 - .4 The screenings compaction zone assembly must be attached via a support flange at the upper end of the screenings transport tube. The support flange must have a minimum thickness of 8 mm.
- .13 Screenings Compaction Zone Assembly
- .1 The compaction/dewatering zone housing must be fabricated from type 316L stainless steel and must consist of a 5 mm thick open-top rectangular body with fully welded 8 mm thick end plates. The lower end of the housing must be fitted with a flexible hose connected to the drain pipe stub to return pressed from the dewatering/compaction zone back to the process stream.
 - .2 The compaction/dewatering zone housing must encase a cylindrical tube with 5mm diameter perforations on its underside to allow water to drain from the pressed screenings. The compaction/dewatering zone tube must be constructed of type 316L stainless steel with a minimum thickness of 3 mm and must be of the same inner diameter as the conveyor tube.
 - .3 The discharge section of the compaction/dewatering zone chamber must be an open rectangular discharge section. The cross sectional expansion of this area from the cylindrical compaction drum must allow the dewatered material to freely fall away from the spiral shaft. The discharge chute bolted to the underside outlet section must be made from type 316L stainless steel.
 - .4 The compaction/dewatering zone housing must be furnished with a latched, hinged type 316L stainless steel access cover with a gasket. The access cover must expose the entire length and width of the compaction/dewatering and discharge area. The access cover must incorporate a safety interlock switch in order to prevent operation of the unit with the access cover open. Units which require the use of any tools to gain access to the compaction zone will not be accepted.
 - .5 A spray bar must be installed inside the compaction enclosure to keep the compaction zone clear and rinse any residual solids from the drain area of the enclosure. Spray bar wash system must be furnished with control solenoid valve, stainless steel piping and fittings, flexible reinforced hoses and 316L stainless steel spray nozzles.
- .14 Spray Wash System

-
- .1 A centralized washing system must be provided to connect all spray wash systems to a common service connection point. The piping manifold must be constructed from type 316L stainless steel. Washwater solenoids and manual ball valves must be factory installed with the manifold assembly.
 - .2 Available non-potable water for fine screen spray wash system is 1.5 L/s at 275 – 414 kPa.
 - .15 Drive Unit
 - .1 Drive unit must be directly connected to the main drive shaft via the reducer's hollow shaft. Designs that incorporate additional chain and sprocket assemblies that might bind or break are not acceptable.
 - .2 The gear reducer must be bolted to the upper compaction/dewatering zone housing end plate.
 - .3 Gear reducer must be a helical gear type. Provide a cast iron frame; design in accordance with AGMA I service.
 - .4 The motor must be explosion proof type 1.5 kW, 1800 RPM, 575 Volt, 3 phase, 60 Hz. The motor must be NEMA design code B and be direct coupled to the reducer.
 - .5 The stub shaft must extend from the gear reducer into the end of the transport tube. Stub shaft must be constructed of high strength alloy steel and must have a protective epoxy coating.
 - .6 The spiral screw assembly must be bolted to the stub shaft via a flanged connection.
 - .7 Chain drives, belt drives, hydraulic drives or designs incorporating a separate upper bearing for the transport screw will not be accepted.

2.5 ANCHOR BOLTS AND FASTENERS

- .1 The fine screens will be mounted on a metallic platform to be provided by others. All anchor bolts for the fine screens to be attached to the platform must be specified by the fine screen manufacturer and made of type 316L stainless steel. The equipment supplier must furnish all anchor bolts, nuts, and washers required for the equipment.
- .2 All fasteners must be type 316L stainless steel. The equipment supplier must furnish all fasteners required for the assembly of the equipment.

2.6 ELECTRICAL

- .1 Provide fine screen and associated equipment to be power operated at 600 volts, 3 phases, 60 Hz.

- .2 Fine screens must be installed in the Headworks building. All drives and electrical installations located inside the Headworks building must meet requirements for a Class 1, Zone 2 area. All equipment wiring, fittings, devices and terminations inside the Headworks building must be explosion proof.
- .3 The control panels for the fine screens will be located in the electrical room so the explosion proof requirement is not applicable for such panels.

2.7 CONTROLS

- .1 The Fine Screen operation will be controlled from Manufacturer-supplied Control Panels. All equipment controllers, motor starters, drives, etc. must be housed within these panels.
- .2 Control Panel: A 600 volt primary control panel must be provided in a NEMA 4X type 316L stainless steel enclosure suitable for wall mounting with the following components to provide proper operation of the equipment:
 - .1 Main disconnect with through door interlock handle.
 - .2 Step down control transformer, and disconnect.
 - .3 Branch circuit protection.
 - .4 Drive motor starter - reversing.
 - .5 Emergency stop pushbutton.
 - .6 Screen HOA switch.
 - .7 Screen FOR switch, spring return reverse to off.
 - .8 Over-torque safety switch.
 - .9 Basket spray wash Open-Close-Auto switch.
 - .10 Dewatering zone spray wash Open-Close-Auto switch.
 - .11 Load monitor must provide overload protection by sensing motor current draw.
 - .12 Hour meter for motor.
 - .13 Run and Off indicating lights.
 - .14 Alarm light indicating over current, and starter overload.
 - .15 Alarm reset pushbutton.
 - .16 Programmable control relay to provide necessary control logic and monitor equipment mounted electrical devices.
 - .17 Run and alarm auxiliary contacts for use by the customer.
 - .18 Barrier relay for float level switch.
 - .19 UL Label.
- .3 Safety Microswitches

-
- .1 Two (2) 120 volt safety interlock switch must be factory mounted to the compaction/discharge zone access door and tank access cover of each fine screen. Interlock switches must prevent operation of the screen while the doors are open. Switch housing must be rated for NEMA 4X.
 - .4 Solenoid Valves
 - .1 Provide two (2) solenoid valves per fine screen to control flow to the spray wash assemblies. Supply stainless steel body solenoid valves. Each valve must be NEMA 4X, 120 volt, single phase, 60 Hz.
 - .5 Local Emergency Stop
 - .1 Provide a local emergency stop push button in a NEMA 4X polycarbonate enclosure.
 - .6 Ultrasonic Level Sensor
 - .1 An ultrasonic level sensor per fine screen must be provided for operation of the units by upstream water level. The level sensor must utilize an ultrasonic beam for measurement of the liquid level and be provided with an LCD display and two C-form contacts corresponding to individual level settings. Sensor must be suitable for installation in a Class 1 Division 2 hazardous area.
 - .7 Operation, Monitoring and Control
 - .1 Screen Hand Operation: Screen to run continuously.
 - .2 Screen Automatic Operation: Screen to cycle based on the level sensor or repeat cycle timer. Provide provisions to prevent excessive starting and stopping of the unit. Cycle timer must be reset after each run initiated by the level sensor.
 - .3 Basket Zone Spray Wash Hand Operation: Spray wash must run continuously.
 - .4 Basket Zone Spray Wash Automatic Operation: Spray wash must run when the spiral assembly is rotating in forward operation.
 - .5 Compaction Zone Spray Wash Hand Operation: Spray wash must run continuously.
 - .6 Compaction Zone Spray Wash Automatic Operation: Spray wash must cycle on and off based on the spray wash cycle timer.
 - .7 Fault Conditions:
 - .1 Momentary motor over load must trip the load monitor, stop the drive motor, and illuminate the alarm indicating light. Reset must be manual on the outside of the control panel.

- .2 Excessive motor current must trip the starter overload relays, stop the drive motor, and illuminate the alarm indicating light. Overload relays must be reset manually on the inside of the control panel.
- .3 Excessive motor torque must stop the drive motor, and illuminate the alarm indicating light. Over-torque relays must be reset manually on the inside of the control panel.

2.8 SPARE PARTS

- .1 Provide all spare parts (except lubricants) that would be normally required for one (1) year of operation of the fine screens.
- .2 Provide one (1) set of spare brushes.
- .3 Provide one set of any special tools required to assemble, disassemble, or maintain the equipment.

Part 3 Execution

3.1 MANUFACTURER'S REPRESENTATIVE

- .1 Arrange for a technically qualified Manufacturer's Representative to attend the installation work, certify correct installation, train operating and maintenance staff and undertake the testing of the system for sufficient periods, to ensure the equipment is installed, operated, and maintained in accordance with the manufacturer's recommended procedures.
- .2 The minimum periods of site attendance are identified in the following table along with the form to be completed on each of these trips. A "day" is defined as eight working hours on site.
- .3 The total number of trips will depend on the Contractor's schedule. The cost of additional trips, to be determined by the Engineer, will be borne by the Contractor.

Item	Description	Total number of days	Form
1	Equipment Delivery		100
2	Installation Assistance (combined with Item 3)		101
3	Witnessing of Equipment Installation	1	102
4	Operator and Maintenance Training (combined with Item 3)	0.5	T1
5	Process Performance Testing	1	103
6	Operator and Maintenance Training (combined with Item 5)	0.5	T2

Item	Description	Total number of days	Form
7	Commissioning	0.5	104
8	Follow-up Inspection	0.5	Report
9	End of Warranty Inspection	0.5	Report

3.2 INSTALLATION

- .1 Verify satisfactory delivery of the equipment by completing Form 100, illustrated in Section 01 79 00.
- .2 Instruct installer in the methods and precautions to be followed in the installation of the equipment. Certify the Contractor's understanding by completing Form 101, illustrated in Section 01 79 00.

3.3 INSTALLATION WITNESSING

- .1 The Contractor must ensure that equipment is installed plumb, square and true within tolerances specified by the Manufacturer and as indicated in the Contract Documents.
- .2 The Contractor must ensure the equipment is installed as required to provide satisfactory service.
- .3 The Manufacturer's Representative must cooperate with the Contractor to deliver a successful installation as documented by Form 102 illustrated in Section 01 79 00.

3.4 PROCESS PERFORMANCE TESTING

- .1 General
 - .1 Except as modified by this section, conduct testing in accordance with the general requirements of Section 01 79 00.
 - .2 Submit a report summarizing the operating parameters assessed during the test period, recommending optimal setpoints and listing final testing data in concise tabular form at the conclusion of the test period.
 - .3 Upon the successful completion of the testing procedure, Form 103 in Section 01 79 00 will be signed.
- .2 Start-up
 - .1 Submit a detailed start-up procedure for approval.
 - .2 Provide site services of the equipment Manufacturer's Representative for the tuning, monitoring, inspecting, and starting of the equipment during the entire start-up procedure.

- .3 Unless otherwise specified water, and electric power will be provided by the Contractor for the start-up period
- .4 Subsequent to proper tuning, perform an initial thorough inspection of all system components, including electrical and instrumentation controls
- .3 Testing
 - .1 Submit a detailed procedure and schedule of sampling and testing for approval
 - .2 Begin testing only after completing the start-up procedure.
 - .1 In the event of unacceptable performance, perform any supplemental testing, analysis, equipment adjustments, modifications, changes, or additions and request a retest of the unacceptable system at no additional cost.

3.5 COMMISSIONING

- .1 Contractor and Manufacturer's Representative to be in attendance during commissioning of the process system that includes the equipment specified in this section to ensure the equipment functions as intended in the process system as documented by Form 104, illustrated in Section 01 79 00. Cooperate with the Commissioning Team in developing the Commissioning Plan for this equipment. Provide assistance as required for system programming, start-up and troubleshooting.

3.6 TRAINING

- .1 The Manufacturer's Representative must provide training to the Owner's Designated Staff in the proper operation and maintenance of the equipment as documented by Forms T1 and T2 in Section 01 79 00.

3.7 FOLLOW-UP INSPECTION

- .1 After a period designated by the Owner (approximately 6 months after commissioning), a qualified Manufacturer's Representative will provide a follow-up inspection of the installation.
- .2 Manufacturer's Representative to submit a report summarizing the performance of the equipment, recommending optimal set points and any operational recommendations.

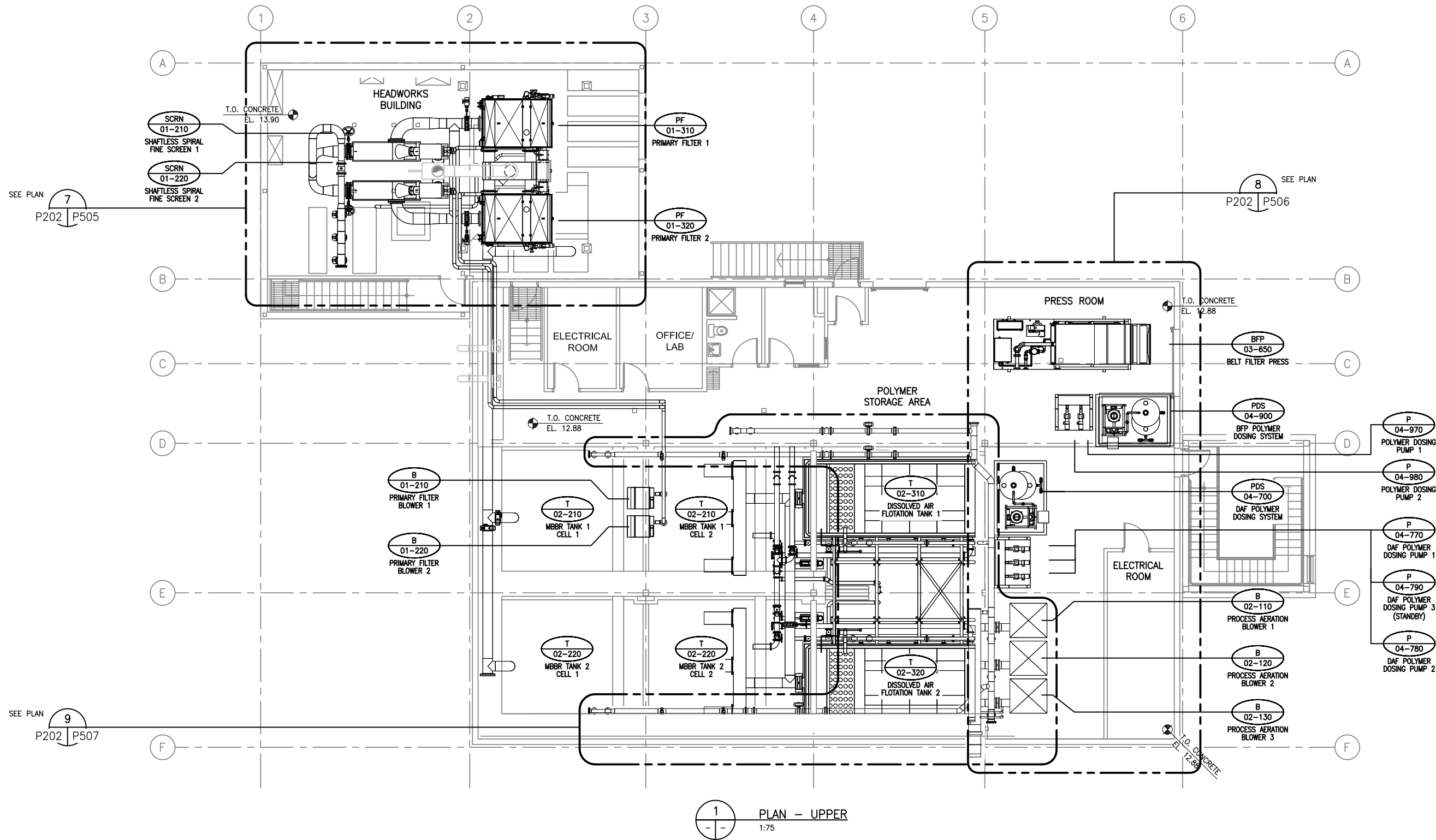
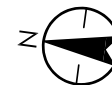
3.8 END OF WARRANTY INSPECTION

- .1 After a period designated by the Owner (approximately 12 months after commissioning), a qualified Manufacturer's Representative will provide a follow-up inspection of the installation.

- .2 Manufacturer's Representative to submit a report summarizing the performance of the equipment, recommending optimal set points and any operational recommendations.

END OF SECTION

APPENDIX A – PRELIMINARY EQUIPMENT LAYOUTS



Revision	By	Appd.	YY.MM.DD
50% DESIGN REVIEW			18.01.08
Issued	By	Appd.	YY.MM.DD

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IQUALUIT WASTEWATER TREATMENT PLANT
UPGRADE
City of Iqaluit, Nunavut

File Name: P202

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2017.10.03
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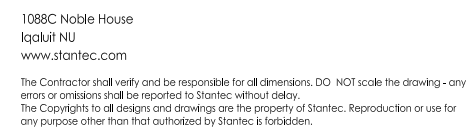
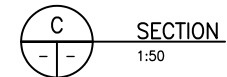
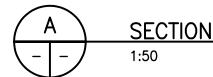
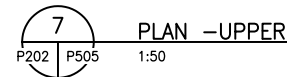
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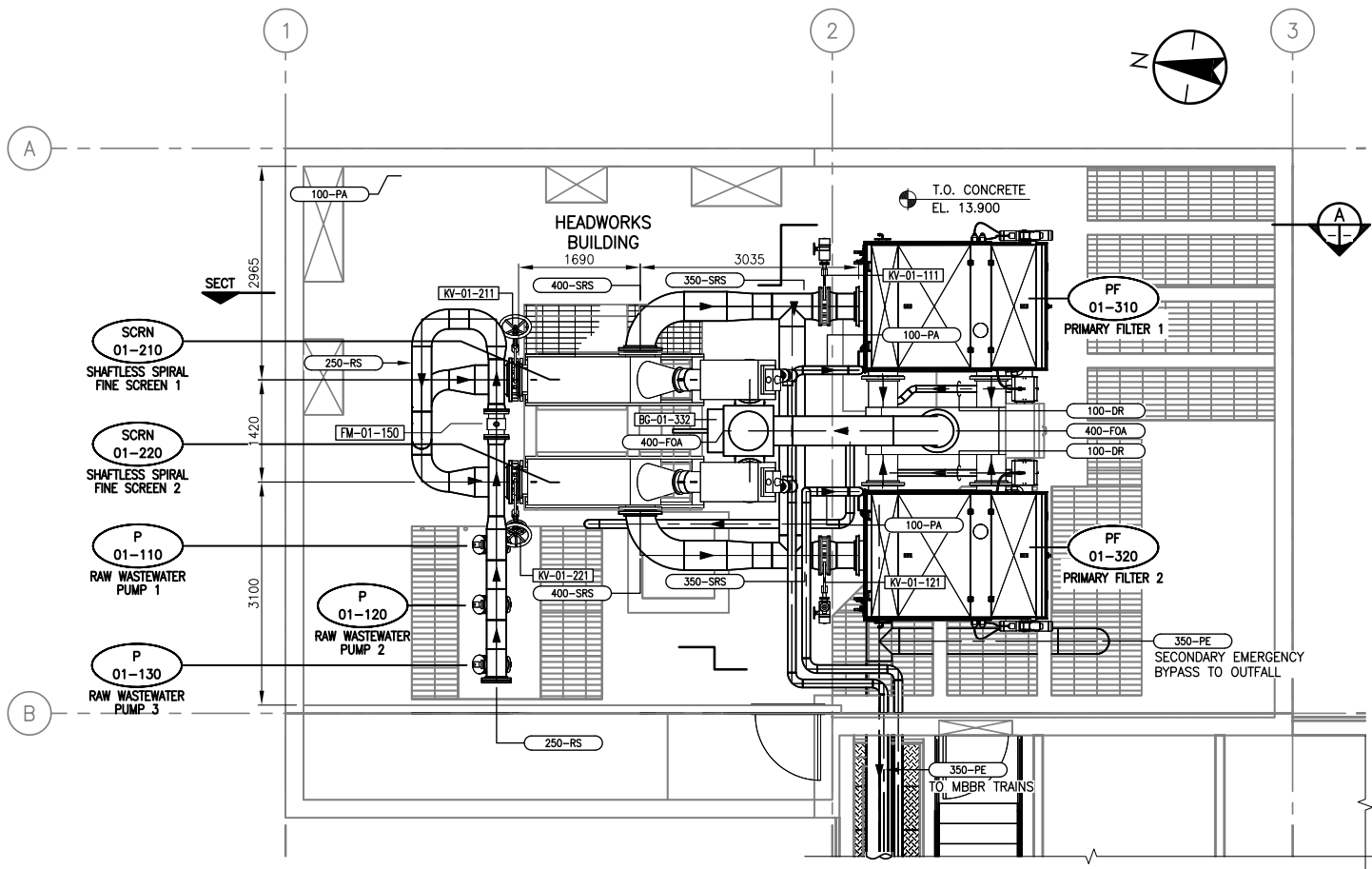
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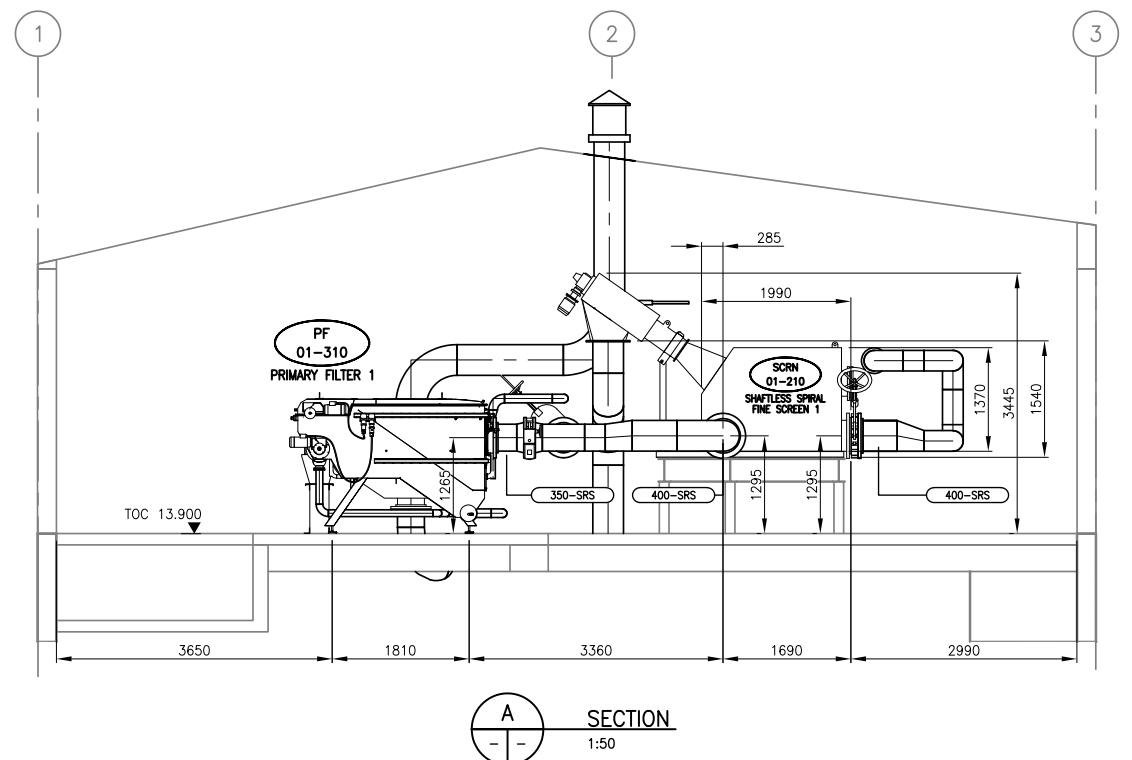


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UPGRADE
City of Iqaluit, Nunavut

File Name:	P505A	T/rahl			2017.10.03
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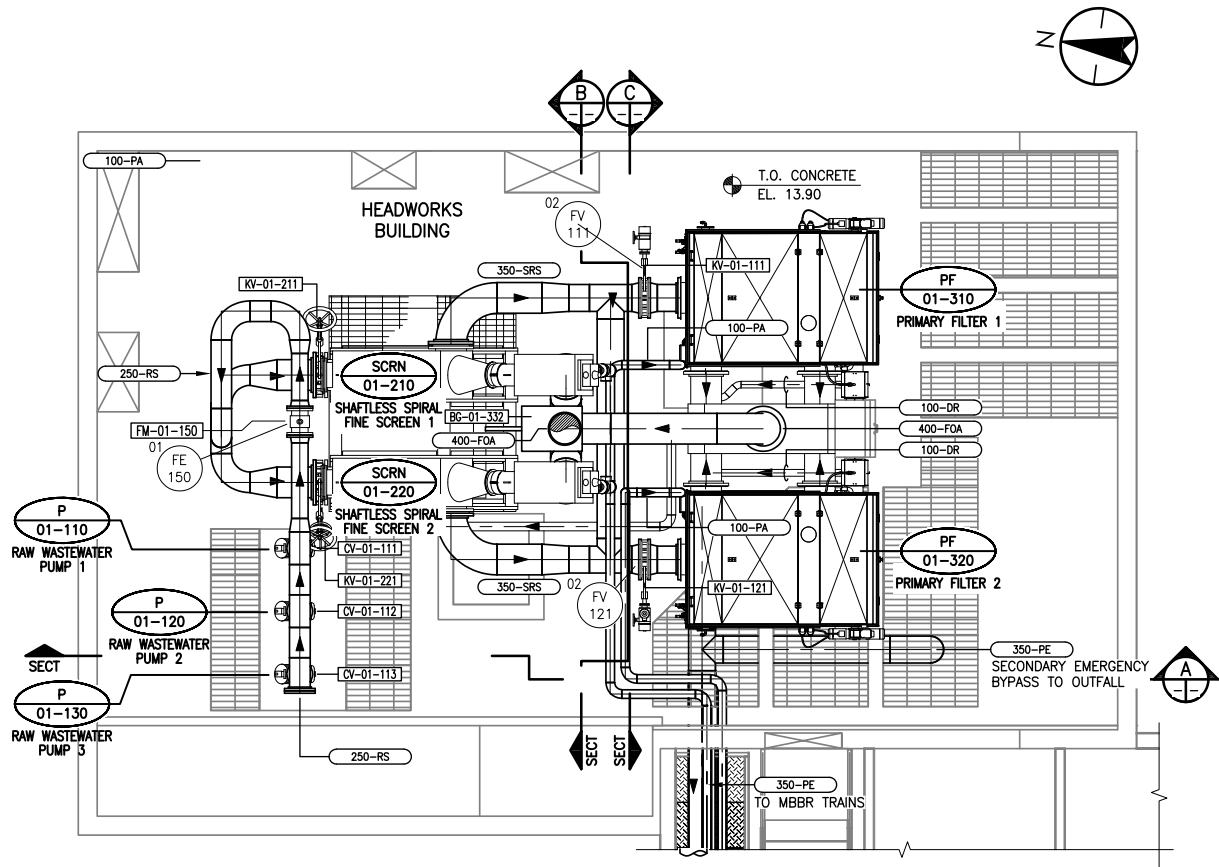
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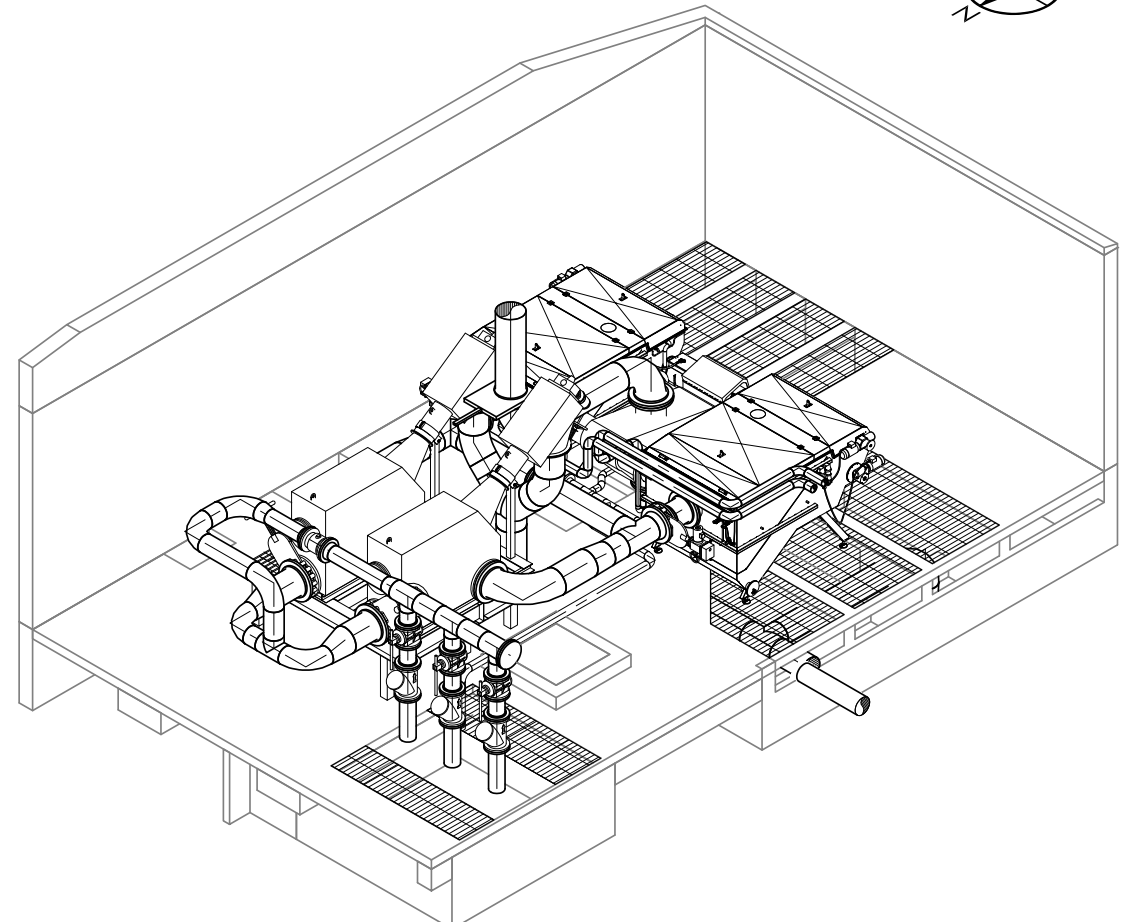
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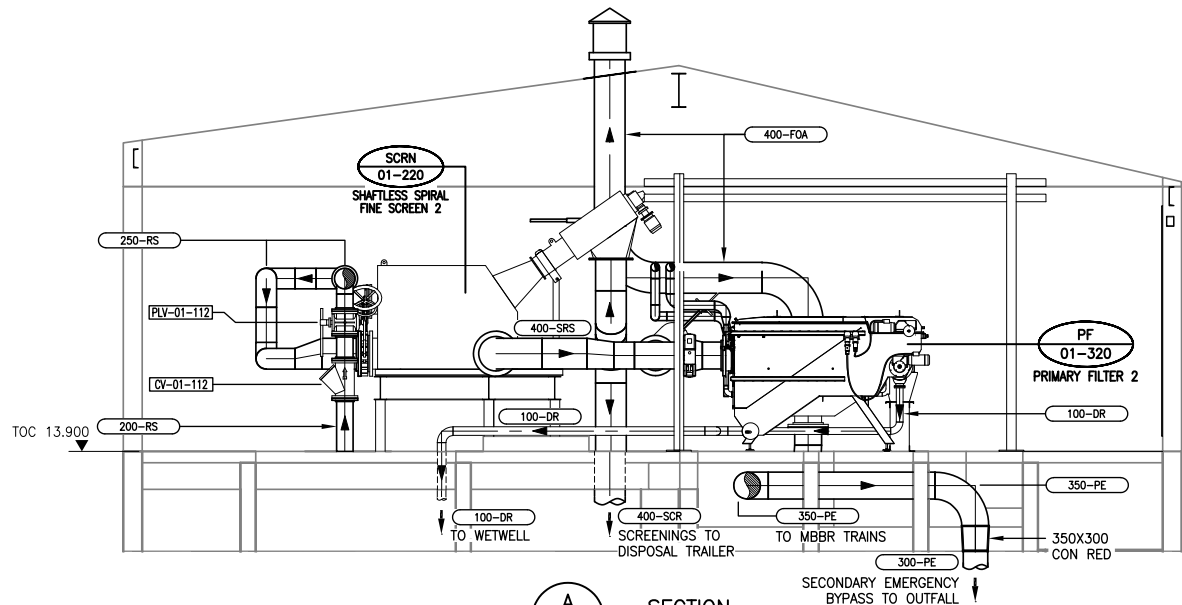
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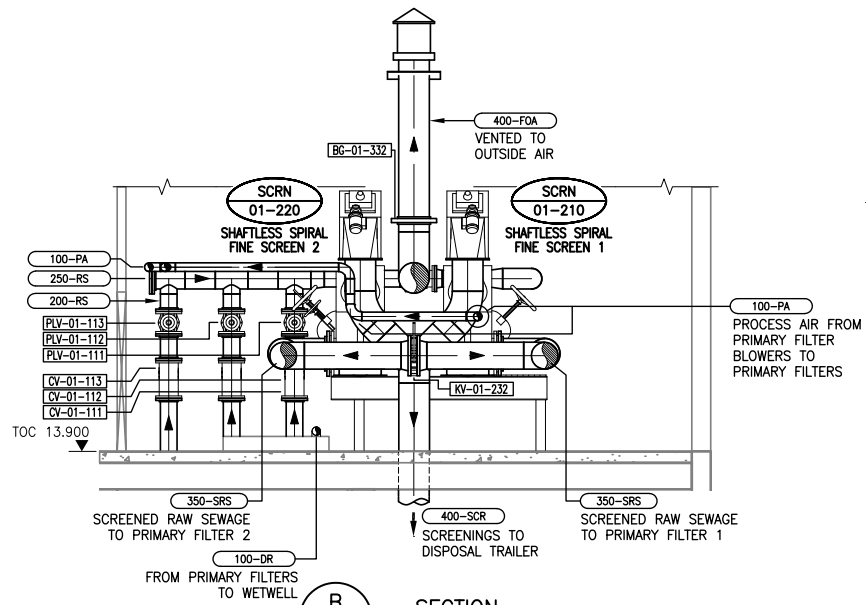
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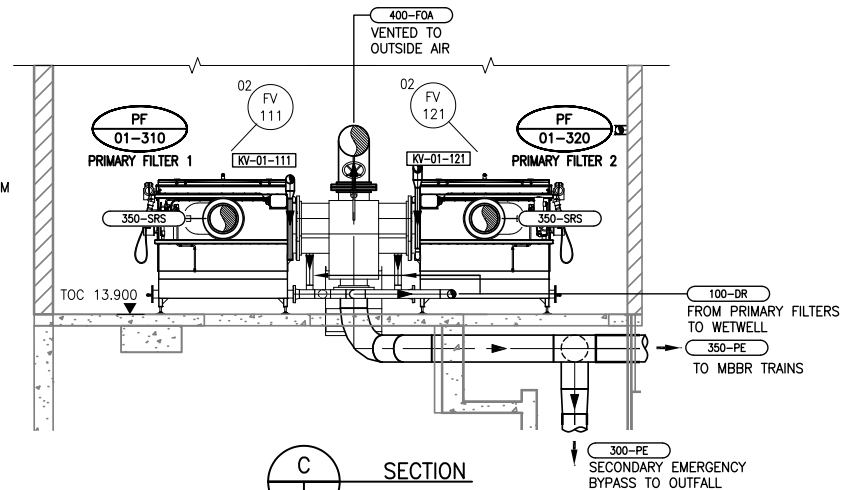
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IQALUIT WASTEWATER TREATMENT PLANT
UPGRADE
City of Iqaluit, Nunavut

File Name: PS05
T:Rahm
Dwn. Chkd. Dgn. 2017.10.03
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UPPER - FINE SCREENS AND PRIMARY FILTERS
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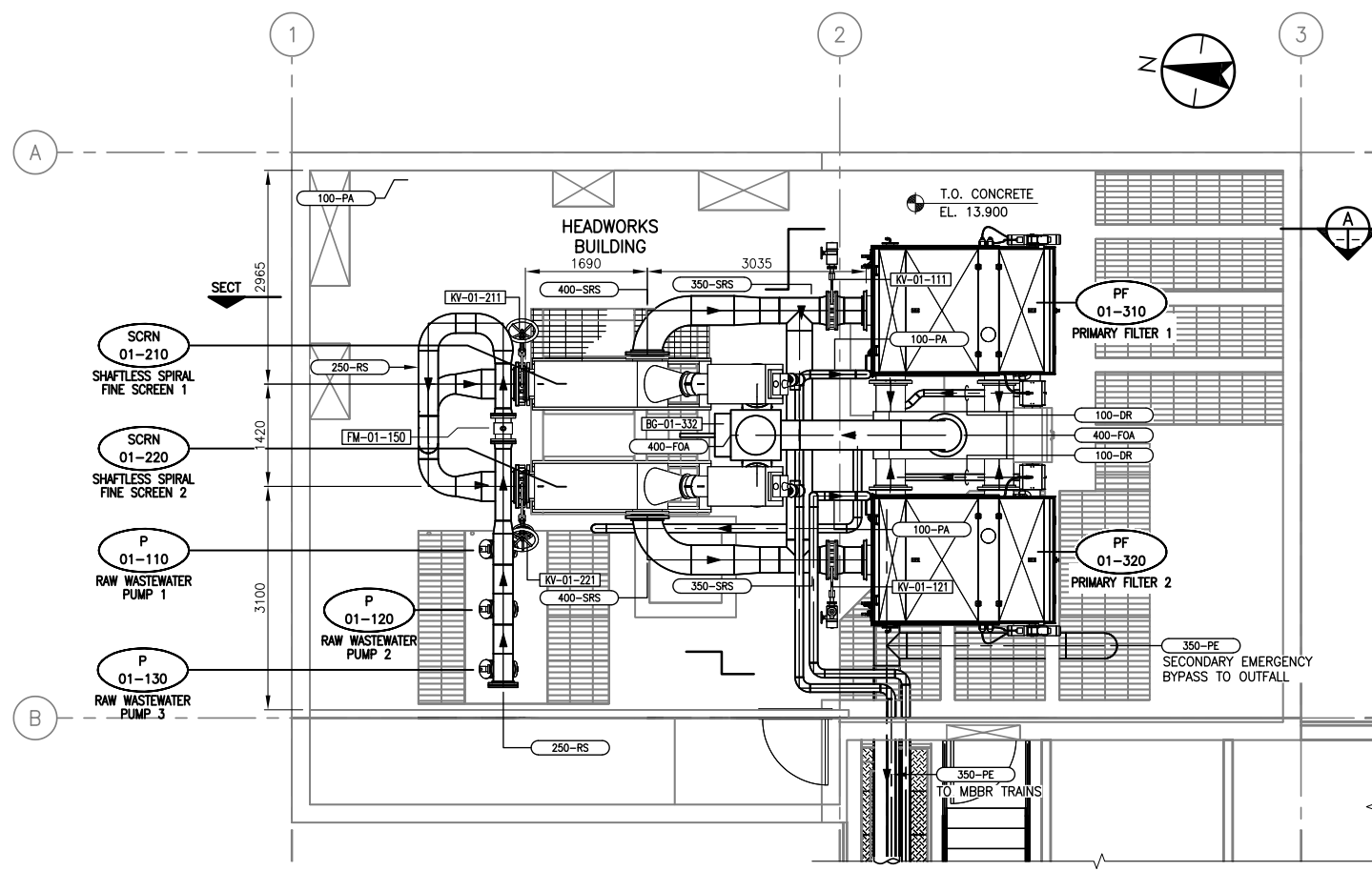
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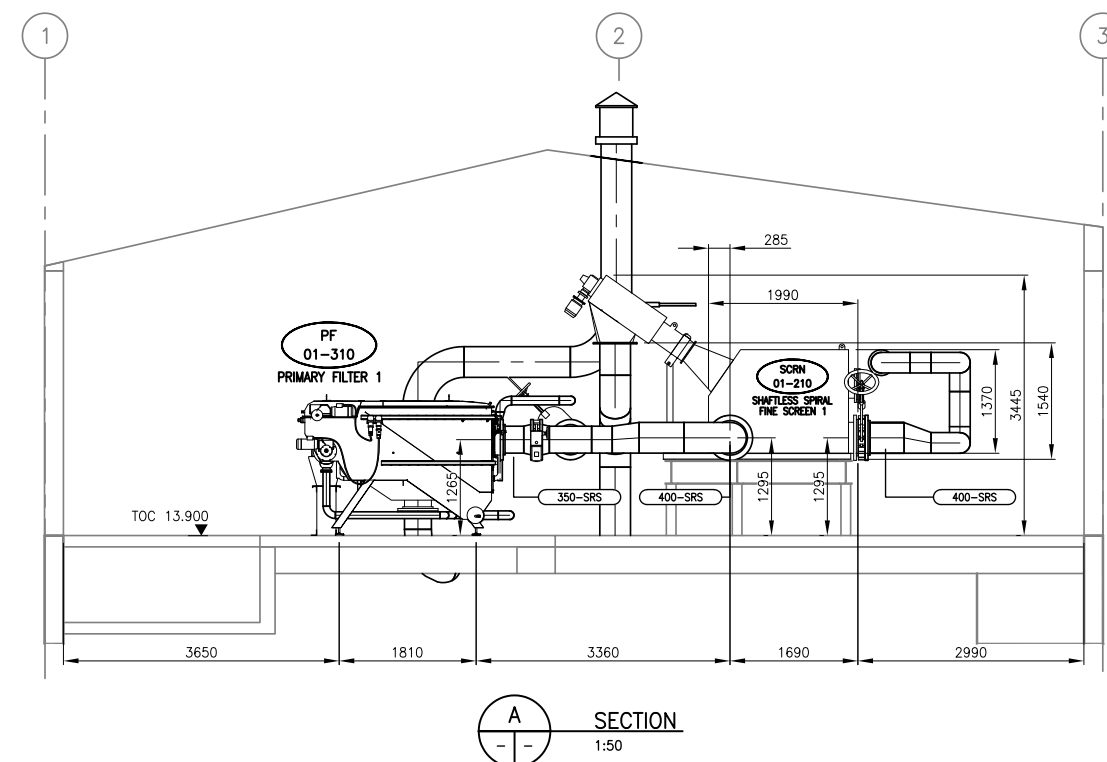
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Iqaluit

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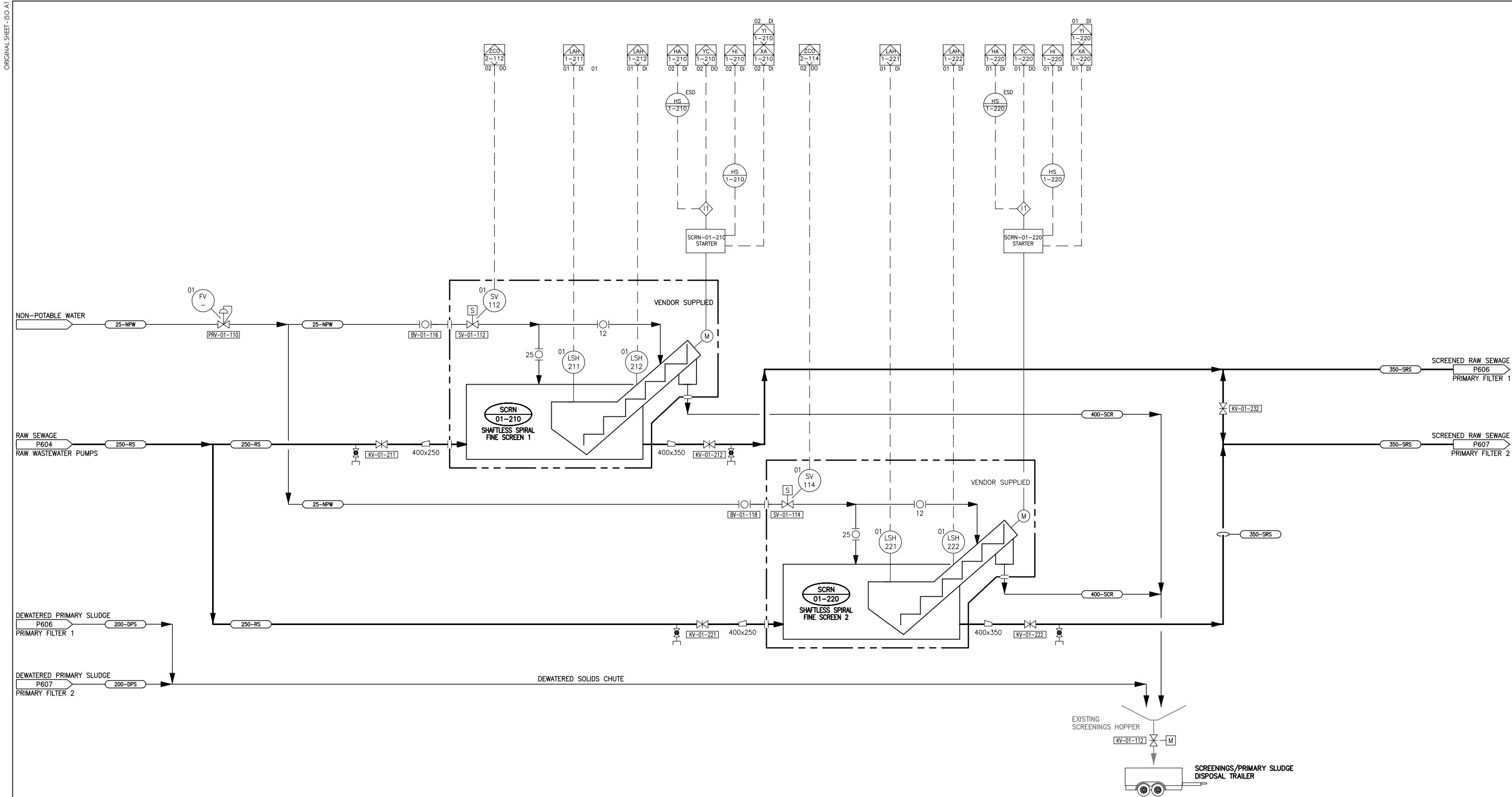
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APPENDIX A – PRELIMINARY P&IDS



SCR-01-210/SCR-01-220
SHAFTLESS SPIRAL SCREENS 1/2
TYPE: SHAFTLESS
CAPACITY: 151 L/s
MOTOR: 1.5 kW
UTILITY WATER: 1.2 L/s

Revision	By	Appd.	YY.MM.DD
50% DESIGN REVIEW	-	-	18.01.08
Issued	By	Appd.	YY.MM.DD

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Client/Project

Iqaluit

AT&AC

IQUALUIT WASTEWATER TREATMENT PLANT
UPGRADE
City of Iqaluit, Nunavut

File Name: P605

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Dwn.

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Dgn.

2017.10.03
YY.MM.DD

Title

PROCESS
PIPING AND INSTRUMENTATION DIAGRAM
SCREENING

Project No.
110126045

Scale
NTS

Drawing No.

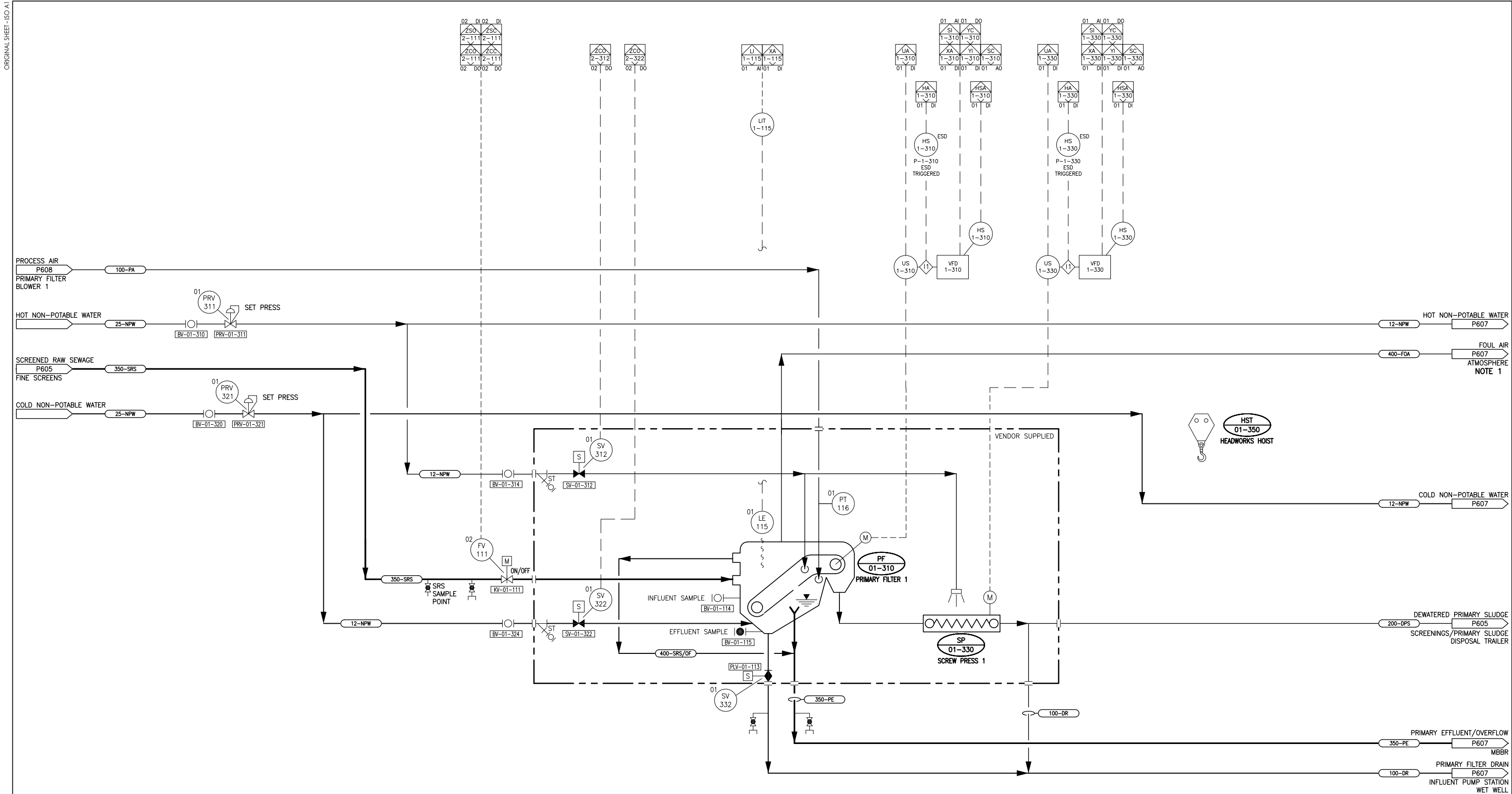
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Revision

P605

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NOTES
1. THE ARRANGEMENT OF PRIMARY FILTERS 1 AND 2
SHARES A UNIQUE FOUL AIR PIPELINE TO ATMOSPHERE.

**PF-01-310
PRIMARY FILTER 1**
TYPE: LEAP PRIMARY
CAPACITY: 121 L/s
FAN MOTOR: 0.18 kW
FILTER BELT MOTOR: 0.75 kW

**SP-01-330
SCREW PRESS 1**
AUGER MOTOR: 0.37 kW

**HST -01-350
HEADWORKS HOIST**
CAPACITY: 1 TONNE
MOTOR: 0.75 kW

Revision	By	Appd.	YY.MM.DD
50% DESIGN REVIEW	-	-	18.01.08
Issued	By	Appd.	YY.MM.DD

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Client/Project



IQALUIT WASTEWATER TREATMENT PLANT
UPGRADE
City of Iqaluit, Nunavut

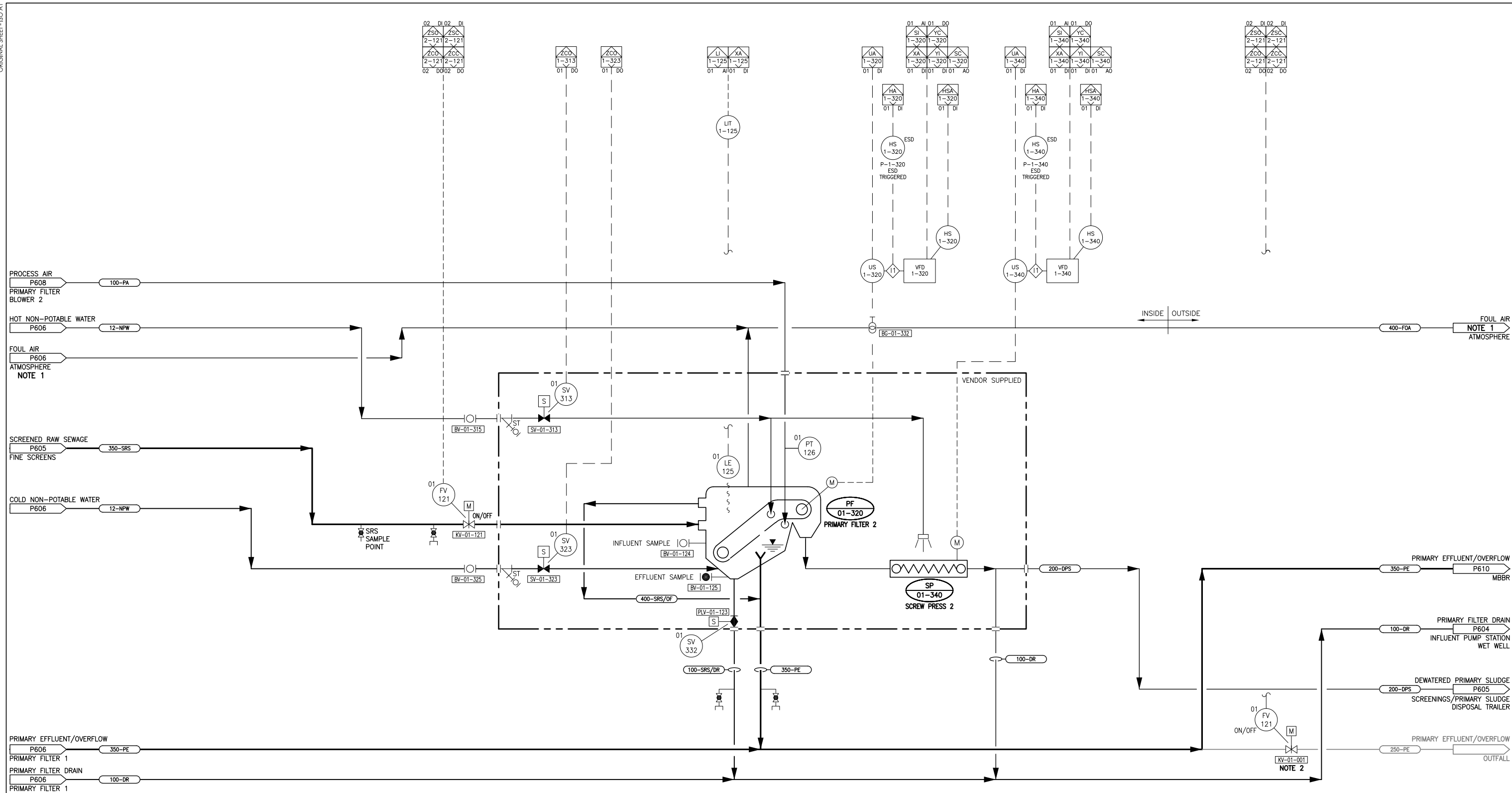
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	Dwn.			YY.MM.DD

Title

**PROCESS
PIPING AND INSTRUMENTATION DIAGRAM
PRIMARY FILTER 1**

Project No. 110126045	Scale NTS
Drawing No.	Sheet Revision

P606 of 0



NOTES

1. THE ARRANGEMENT OF PRIMARY FILTERS 1 AND 2
SHARES A UNIQUE FOUL AIR PIPELINE TO ATMOSPHERE.
2. REPLACE EXISTING MANUAL VALVE WITH NEW ELECTRICALLY OPERATED ON/OFF VALVE

PF-01-320
PRIMARY FILTER 2

TYPE:	LEAP PRIMARY
CAPACITY:	121 L/s
FAN MOTOR:	0.18 kW
FILTER BELT MOTOR:	0.75 kW

SP-01-340
SCREW PRESS 2
AUGER MOTOR: 0.37 kW

Revision	By	Appd.	YY.MM.DD
50% DESIGN REVIEW	-	-	18.01.08
Issued	By	Appd.	YY.MM.DD

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IQALUIT WASTEWATER TREATMENT PLANT
 UPGRADE
 City of Iqaluit, Nunavut

File Name: P607

TRohl
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2017.10.03
YY.MM.DD

Title

PROCESS
PIPING AND INSTRUMENTATION DIAGRAM
PRIMARY FILTER 2

Project No.
110126045

Scale
NTS

Drawing No.

Sheet

Revision

P607

of _____

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