AUTHENTIFICATION AND VALIDATION	
Site Works, Process and Mechanical	94184 2022-11-24
Architectural and Structural	2022-November-24 ID# 61349
Electrical	24 Nov. 2022 ID# 127263
Permit Holder	PERMIT TO PRACTICE *ISL Engineering and Land Services Ltd.* RM Signature: RM APEGA ID: 94184 Date: 2022-11-24 PERMIT NUMBER: P 4741 The Association of Professional Engineers and Geoscientists of Alberta PERMIT TO PRACTICE MAGNA IV ENGINEERING, INC. RM SIGNATURE: RM APEGA ID #: 127263 DATE: 24 Nov. 2022 PERMIT NUMBER: P008767 The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

DIVISION 01

GENERAL REQUIREMENTS

1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract generally comprises the following:
- .1 Construction of a new wet well/dry well pump station and new control building
- .2 Connect existing inlet sewer to pump station and install part discharge forcemain and connect to existing
- .3 Utilities coordination and connections, including water, gas, communications, and power
- .4 Miscellaneous site works, including accesses, yards, fencing and gates, topsoil, and sodding.
- .5 SCADA and Systems Integration
- .6 Hydrostatic testing
- .7 Testing and commissioning of mechanical, electrical, and control systems.

1.2 WORK SCHEDULE

.1 Initiate work of this project within 2 weeks of award.

.2 Complete work by the date(s) set out in 00 90 00 Special Provisions

1.3 CONTRACTOR USE OF PREMISES

.1 Unrestricted use of site until Substantial Performance.

.2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.3 Maintain fire access/control.

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.4 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy of each document as follows:
- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 List of Outstanding Shop Drawings.
- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 ACCESS AND EGRESS

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

1.2 SMOKING ENVIRONMENT

.1 Smoking is not allowed on site.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
  .1 CCDC 5B-2010 Construction Management Contract – for Services and Construction

.2 Project Supplementary Conditions

.3 Section 01 45 00 - Quality Control

.4 Section 01 91 00 - Commissioning

.5 Section 26 80 50 - Speciality Systems Integrator

1.2 CONDITIONS AND DEFINITIONS

.1 The conditions of Allowances in CCDC 5B (2010) Edition are the conditions of Allowances in this Contract.

.2 The definition of Allowances in CCDC 5B (2010) Edition is the definition of Allowances in this Contract.

1.3 RESPONSIBILITIES

.1 Consultant Responsibilities:
  .1 Consult with Contractor for consideration and selection of Products, suppliers, installers, and services.
  .2 Owner and Consultant to select Products and services.
  .3 Prepare Change Order if required.

.2 Contractor Responsibilities:
  .1 Assist Consultant in selection of Products, suppliers and installers.
  .2 Obtain proposals from suppliers and installers and offer recommendations.
  .3 On notification of selection by Consultant or Owner, execute purchase agreement with designated supplier and installer.
  .4 Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
  .5 Promptly inspect Products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

1.4 COSTS INCLUDED AND COSTS NOT INCLUDED CASH ALLOWANCES

.1 SPEC NOTE: CCDC General Conditions identifies Cash Allowances but with no definitive explanation as to administering the cash allowance itself. The following paragraphs will assist in that regard.

.2 Costs Included in Cash Allowances: Cost of Product to Contractor, less applicable trade discounts; delivery to site, and applicable taxes.

.3 Unless otherwise explicitly indicated in the particular Cash Allowance items listed in Cash Allowance schedule below in paragraph 1.5, the following costs of the Contractor are NOT included in Cash Allowances: insurance, incidental labour, supervision, bonding if applicable, equipment rental, and overhead and profit.

.4 Contractor’s costs not allowed to be included in Cash Allowance must be included elsewhere in the Contract.

.5 Differences in costs will be adjusted by Change Order.

1.5 CASH ALLOWANCES SCHEDULE

.1 Allowances Schedule:

Cash Allowance Item	**Stipulated Sum Included**
Speciality Systems Integrator	$40,000
Utility Services	$20,000
Materials Testing	$10,000
Building Security Systems	$10,000
Arc Flash Study	$12,500

1.6 Payment Procedures:

.1 Submit one copy of all required supporting invoice information with next application for payment.

.2 Pay invoice on approval by Consultant.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INTENT

.1 This section indicates the criteria for use of optional products listed in the specification and provision for proposing changes to acceptable materials listed during the Bid Period and during the course of construction.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 DEFINITIONS

.1 Acceptable Materials: The term Acceptable Materials is used to specify products by trade name, manufacturer, catalogue number, model number, or similar reference, and is used within the Contract Documents as follows:
  .1 Acceptable Materials listings are based on the Consultant's determination that materials meet specified requirements.
  .2 Acceptable Materials listings are deemed to establish the standard of acceptance that the Consultant will consider appropriate for the Work.
  .3 Any product listed in the Acceptable Materials listing may be used to establish the Bid Price.

.2 Basis-of-Design Materials: The term Basis-of-Design Materials is used to specify a specific material name, manufacturer, catalogue number, model number or similar reference and is used as follows:
  .1 Basis-of-Design Materials are used to establish Consultant's preference for a single source product listing based on performance, appearance or configuration.
  .2 Use the Basis-of-Design Material to establish the Bid Price, unless an Addendum is issued adding additional Acceptable Materials.
  .3 Basis-of-Design Materials designation does not limit the Contractor's ability to submit Proposed Substitutions in accordance with Substitutions requirements of this Section and specific performance requirements listed in Technical Specification Sections.

.3 Non-proprietary specification means a specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does **not** include proprietary names of products or manufacturers.

.4 Substitution means a proposal from a Contractor to provide a product, material, or item of equipment not specified in the Contract documents but functionally equivalent and readily exchangeable to a specified item; for consideration by the Consultant and Owner.

.5 Alternate: If a Contractor proposes to exchange a Product specified within the Contract Documents for another Product within the Contractor's bid submission this Product shall be referred to as an Alternate. The Contractor shall confirm that the Alternate Product is equivalent to the originally specified Product and that it meets specific requirements and intent of the Contract Documents, prior to including it in the bid submission.

.6 Substitute: If a Contractor proposes to exchange a Product specified within the Contract Documents for another Product after the Contract has been awarded, this Product shall be referred to as a Substitute. The Contractor shall confirm that the Substitute Product is equivalent to the originally specified Product and that it meets the specific requirements and intent of the Contract Documents as part of the shop drawings process.
  .1 Where the Contractor is forced to use Substitute Products, the Contractor shall inform the Consultant in writing as soon as the issue is identified.

1.3 SUBMITTALS

.1 When requested by the Consultant, submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:
  .1 Product identification, including manufacturer's name and address.
  .2 Written verification that the substitute products can be obtained, meet the performance required for the project, and meet requirements of the Building Code and other applicable regulations.
  .3 Manufacturer's literature providing product description, applicable reference standards, and performance and test data.
  .4 Samples, as applicable.
  .5 Name and address of projects on which product has been used and date of each installation.
  .6 For substitutions and requests for changes to accepted products, include in addition to the above, the following:
    .1 Itemized comparison of substitution with named product(s). List significant variations.
    .2 Designation of availability of maintenance services and sources of replacement materials.
    .3 Any changes required in work to accommodate such substitutions. A later claim by Bidder for an addition to contract price because of changes in work necessitated by use of substitutions shall not be considered.
    .4 Sufficient Information to enable the Consultant to determine acceptability of such products.
    .5 Complete information on revisions including dollar amounts of additions or reductions from the Bid Price including revisions to other work.

1.4 PRODUCT OPTIONS

.1 For products specified by non-proprietary specification:
  .1 Select any product, assembly or material that meets or exceeds the specified standards for products specified only by referenced standards and performance criteria.

.2 Acceptable Materials: Select any named product, assembly or material contained in the listing of Acceptable Materials.

.3 Basis-of-Design Materials: Use the named product contained in the Basis-of-Design Material listing, unless an addendum is issued indicating acceptance of additional Acceptable Materials.

1.5 SUBSTITUTIONS

.1 The Contractor will assemble requests for substitutions requested by subcontractors and submit to the Consultant for review.

.2 The Consultant will review proposed substitute products for acceptability only when submitted by the Contractor; the Consultant will not review requests submitted independently by subcontractors.

.3 No substitutions will be permitted without the Consultant's written acceptance; the Contractor will be required to remove products and replace with specified materials or provide a credit to the value of the Contract at the Consultant’s discretion where substitutions are found in the Work that have not been formally accepted by the Consultant and Owner.

.4 The Consultant is not obliged to accept any Proposed Substitution offered by the Contractor, and reserves the right to dismiss any item with no further explanation.

.5 Substitute Products: Where substitute products are permitted, unnamed products may be accepted by the Consultant, subject to the following:
- .1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.

.6 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers may be accepted by the Consultant, subject to the following:
- .1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturer(s). Substitutions shall not require revisions to the Contract Documents.

.7 In making a proposal for Substitution the Contractor represents:
- .1 That they have personally investigated the proposal and (unless the proposal explicitly states otherwise) determined that it performs in a similar way or is superior to the product or method specified.
- .2 That the same guaranty will be furnished as for the originally specified product or construction method.
- .3 That they will coordinate installation of the accepted substitute into the Work, making such changes in the Work as may be required to accommodate the change.
- .4 That they will bear costs and waive claims for additional compensation for costs and time that subsequently become apparent arising out of the substitution.
- .5 That the Contractor and/or manufacturer has confirmed that all maintenance requirements can be performed on the equipment in this specific project (i.e. all access doors can be opened and all maintenance areas are easily accessible).

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INTENT

.1 To give a direction to contractors on the intended process and documentation required when inquiring about an interpretation of the Contract Document. Requests for Information will henceforth be referred to as RFI's.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 CONDITIONS AND DEFINITIONS

.1 Requests for Interpretation refers to a document submitted by the Contractor to the Consultant in which a clarification of the Contract Document is required.

.2 A Field Clarification Notice refers to the document submitted to the Contractor by the Consultant in response to a Request for Interpretation.

.3 The Work executed under Requests for Interpretation shall conform and adhere fully to the Contract Documents.

.4 Requests for Interpretation will only apply to inquiries made after award of contract.

.5 RFI's and Field Clarification Notices shall be numbered with a three digit number beginning with 001

1.3 PROCEDURE

.1 The Contractor shall, if a clarification in the Contract Document is required, submit an RFI on form 100 in a clear and concise manner the items that require clarification. The contractor will also specify the date that he needs a field clarification notice to avoid a delay in the work.

.2 Upon review of form 100 the Consultant will engage all necessary resources to provide a field clarification notice on form 101 which clearly provides direction in response to the RFI.

.3 A field clarification notice does not authorize the Contractor to perform scopes of work outside of the Contract Document.

1.4 RESPONSIBILITIES

.1 Consultant Responsibilities:
- .1 Review all submitted RFI's in reference to the Contract Document and provide clarification to the contractor within a period of ten (10) working days.
- .2 Consult with any party responsible for the design that may have relevant information to include in the field clarification notice.
- .3 Provide a response including drawings through the field clarification notice that incorporates the best interests of both the Owner and the Project.
- .4 Create a spreadsheet to track all RFI's and Field Clarification Notices throughout the project

.2 Contractor Responsibilities:
  .1 Provide RFI's to the Consultant so that a field clarification notice can be provided within ten (10) working days that does not impact the construction schedule.
  .2 The Contractor shall be responsible to pass the field clarification notice to all relevant subcontractors and suppliers.
  .3 When a field clarification notice is provided the Contractor shall include this clarification in their record drawings.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

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Form 100 - Request for Interpretation (RFI)

7909 – 51 Avenue, Edmonton, AB T6E 5L9 T: 780.438.9000 F: 780.438.3700

Project Information

Project Name: _____ Project No.: _____

Client Name: _____ Contractor Name: _____

RFI Information

Project RFI #: _____ Revision #: _____

Submission Date: _____

RFI Title: _____

Related Specifications: _____

Related Drawings: _____

Attachments: _____

Number of Pages: (Including Cover) _____

RFI Addressed To:

Name: _____

Company: _____

Contact Number: _____

Email: _____

RFI Submitted By:

Name: _____

Company: _____

Contact Number: _____

Email: _____

Inquiry Details:

ISL Engineering and Land Services

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Form 101 – Clarification Notice (CN)

7909 – 51 Avenue, Edmonton, AB T6E 5L9 T: 780.438.9000 F: 780.438.3700

Project Information

Project Name: _____ Project No.: _____

Client Name: _____ Contractor Name: _____

CN Information

Project CN #: _____ RFI Reference #: _____

Response Date: _____

CN Title: _____

Related Specifications: _____

Related Drawings: _____

Attachments: _____

Number of Pages: (Including Cover) _____

CN Addressed To

Name: _____

Company: _____

Contact Number: _____

Email: _____

CN Submitted By

Name: _____

Company: _____

Contact Number: _____

Email: _____

Response:

1 General

1.1 INTENT

.1 To provide the process by which Change Directives, as defined within CCDC 5B, are issued and processed under this Contract.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 CONDITIONS AND DEFINITIONS

.1 Change Directives refer to a document issued to the Contractor by the Consultant, which adjusts the Work as referenced within CCDC 5B GC 6.3.

.2 A Change Directive Response refers to the documentation submitted by the Contractor to the Consultant, in which the Contractor submits their cost and request for an extension in the Contract Time, where applicable.

.3 “Force Account Sheets” are defined as the Contractor’s daily logs which records the labour effort, equipment effort and materials that have been used to complete a scope of Work related to a Change Directive.

.4 The Work executed under Change Directives shall conform and adhere fully to the Contract Documents.

.5 Change Directives and Change Directive Responses shall be numbered with a three digit number beginning with 001.

.6 Change Directives and Change Directive Responses processing will be tracked by the Consultant and Contractor and reviewed at each Progress Meeting.

1.3 RESPONSIBILITIES

.1 With regards to Change Directives and Change Directive Response the Consultant’s responsibilities are to:
- .1 Generate and process Change Directives in a timely manner
- .2 Review and accept where appropriate all Daily Force Account Sheets in a timely manner
- .3 Monitor the Contractor’s performance to ensure the Change Directive is being completed accurately and efficiently.
- .4 Work proactively with the Contractor and Owner to resolve adjustments to the *Contract Price* and *Contract Time*.

.2 With regards to Change Directives and Change Directive Response the Contractors responsibilities are to:
- .1 Review and acknowledge signed Change Directives in a timely manner.
- .2 Execute the Work within the Change Directive in a proactive, efficient and reasonable manner.
- .3 Ensure all relevant instructions and information is passed onto Subcontractors and Suppliers in a timely manner and ensure that the Work is completed as specified.

.4 Provide completed Daily Force Account Sheets within the timeframe listed within this Section.
.5 Provide fully completed Change Directive Responses within a reasonable timeframe with justifiable and reasonable costs.
.6 Adhere to all instructions and specifications stated or referenced to in the Change Directive and the Contract.
.7 Work proactively with the Consultant and Owner to resolve adjustments to the *Contract Price* and *Contract Time*.

1.4 CHANGE DIRECTIVE AND RESPONSE PROCEDURE

.1 If a change to the Work is required, the Consultant will create a Change Directive using Form 102. Any supporting information, drawings, sketches etc, will be included within the Change Directive.

.2 Change Directives and Responses, including supporting information, drawings and sketches, must be created in a clear and concise manner in an electronic format.

.3 Upon completion, Consultant will sign the Change Directive and subsequently issue the Change Directive to the Owner for review and signing.

.4 The Owner will return the signed Change Directive to the Consultant, upon which the Consultant will formally issue the Change Directive to the Contractor.

.5 Upon receipt of a Change Directive the Contractor shall review and acknowledge acceptance of the Change Directive by signing Form 102 as indicated, and returning the signed Change Directive to the Consultant.

.6 If the Contractor is not prepared to accept the issued Change Directive, the Contractor and Consultant shall work together in the best interest of the project, to resolve the change in Work. Once resolved, a revised Change Directive will subsequently be issued using the above process.

.7 Once accepted, the Contractor shall proceed with completing the change in the Work.

.8 Within 24 hours of the end of a day's activities associated with a Change Directive, the Contractor will submit to the Consultant for acceptance a Force Account Sheet.

.9 Separate Force Account Sheets must be submitted for each Change Directive that is worked upon for a particular day.

.10 The format and the information included within a Force Account Sheet shall be agreed to by the Consultant and Contractor upon initiation of the project.

.11 A daily submitted Force Account Sheet shall be signed by the Contractor's Site Representative as certification that the Force Account Sheet is an accurate record of the Work completed for that day, and as a minimum shall include
.1 Date that the Work was completed on with regards to a specific Change Directive.
.2 Description of the Work undertaken for the day associated with a specific Change Directive
.3 Classification of labour and manhours for the day associated with a specific Change Directive.

.4 Equipment description and hours for the day associated with a specific Change Directive.
.5 Description of materials and quantities used associated with a specific Change Directive.
.6 Photographs that are representative of the Work undertaken for the day associated with a specific Change Directive.
.7 If the Contractor wishes to claim an overtime rate on any labour they must provide evidence of a regular working shift (ie. Timesheet, sign-in sheets)

.12 Should the Contractor not comply with the above clause, the information not previously accepted by the Consultant, shall be incorporated into the final costs for the Change Directive at the discretion of the Consultant.

.13 Once the change in the Work has been fully completed, the Contractor shall in a timely manner compile and submit their total incurred costs to the Consultant, using the Change Directive Response (Form 103).

.14 All supporting cost information (i.e. invoices, accepted Force Account Sheets and material receipts) shall be attached to the submitted Change Directive Response for review by the Consultant.

.15 If the Contractor believes that an adjustment of the *Contract Time* is warranted, the proposed adjustment in the date of *Substantial Performance of the Work* shall be included within the Change Directive Response.

.16 Only Change Directives that impact the agreed Critical Path associated with the Work shall be considered when proposing adjustments in the *Contract Time*.

.17 Acceptable costs and the overhead and profit amounts for both the Contractor and the Subcontractor shall be applied in accordance with Section 01 26 63

.18 Subsequent Changes Orders will be processed as per Section 01 26 63.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

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Form 102 – Change Directive (CD)

7909 – 51 Avenue, Edmonton, AB T6E 5L9 T: 780.438.9000 F: 780.438.3700

Project Information

Project Name: _____ Project No.: _____

Client Name: _____ Contractor Name: _____

Change Directive Information

CD No.: _____ Date of Issue: _____

CD Title:: _____

Attachments: _____

Number of Pages: (Including Cover) _____

Related Contract Documents: _____

Change Directive Addressed To

Name: _____

Company: _____

Contact Number: _____

Email: _____

Change Directive Submitted By

Name: _____

Company: _____

Contact Number: _____

Email: _____

As provided in GC 6.3 – CHANGE DIRECTIVE in CCDC 5B, the *Owner* directs the *Contractor* to make the following changes in the *Contract*. The adjustments to the *Contract Price* will be established according to the provisions of paragraph 6.3.2, 6.3.3, and 6.3.4 of GC 6.3 and adjustment to *Contract Time* will be established according to the provisions of paragraph 6.3.6 of GC 6.3. The adjustment of both Contract Price and Contract Time will also adhere to any adjustments made to the GCs by Supplementary Conditions (Section 00 73 00)

Description:

Form 102 – Change Directive (CD)

Prepared by the Consultant:	ISL Engineering and Land Services	Signature	Date
Issued by the Owner:	Client Representative	Signature	Date
Acknowledged by the Contractor:	Contractor	Signature	Date

Possible Schedule Impact: Yes ☐ No ☐ **Contractor Initial:** _____

Possible Cost Impact: Yes ☐ No ☐ **Contractor Initial:** _____

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Form 103 – Change Directive Response (CDR)

7909 – 51 Avenue, Edmonton, AB T6E 5L9 T: 780.438.9000 F: 780.438.3700

Project Information

Project Name: _____ Project No.: _____

Client Name: _____ Contractor Name: _____

Change Directive Response Information

Change Directive Response #: _____ Related Change Directive #: _____

Date of Response: _____

Change Directive Response Title: _____

Attachments: _____

Number of Pages: (Including Cover) _____

Change Directive Response Addressed To

Name: _____

Company: _____

Contact Number: _____

Email: _____

Change Directive Response Submitted By

Name: _____

Company: _____

Contact Number: _____

Email: _____

Change Directive Response Details:

Total Proposed Cost of Change Directive Excluding GST _____

Proposed Adjustment to Date of Substantial Performance of The Work _____ **Working Days**

_____

Contractor Signature

The Contractor acknowledges that the price quoted for the above work includes all direct and indirect costs, including coordination of the work by signing this Change Directive.

1 General

1.1 INTENT

.1 To provide the process by which Contemplative Change Notices are issued and processed under this Contract.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 CONDITIONS AND DEFINITIONS

.1 A Contemplated Change Notice refers to a document issued to the Contractor by the Consultant, with the consent of the Owner, which details a proposed change in the Work.

.2 A Contemplated Change Notice does not constitute authority for the Contractor to proceed with the work outlined within the Contemplated Change Notice.

.3 A Contemplated Change Response refers to the documentation submitted by the Contractor to the Consultant in response to a Contemplated Change Notice.

.4 The Contemplated Change Response shall include the total adjustment in both the *Contract Price* and *Contract Time* to complete the change in the Work detailed within the Contemplated Change Notice.

.5 The Work proposed under a Contemplated Change Notice shall conform and adhere fully to the Contract Documents.

.6 Contemplated Change Notices and Contemplated Change Responses shall be numbered with a three digit number beginning with 001.

.7 Contemplated Change Notices and Contemplated Change Responses processing will be tracked by the Consultant and Contractor and reviewed at each Progress Meeting.

1.3 RESPONSIBILITIES

.1 With regards to Contemplated Change Notices and Contemplated Change Responses the Consultant's responsibilities are to:
- .1 Generate and process Contemplated Change Notices in a timely manner.
- .2 Work proactively with the Contractor to ensure that the submitted Contemplated Change Response are complete.
- .3 To review the received Contemplated Change Responses in conjunction with the Owner.
- .4 To facilitate the decision as to whether or not to proceed with the contemplated change in the Work.

.2 With regards to Contemplated Change Notices and Contemplated Change Responses the Contractor's responsibilities are to:
- .1 Provide a response in the form of a Contemplated Change Response within a reasonable timeframe with justifiable and reasonable costs.
- .2 Adhere to all instructions and specifications stated or referenced to in the Contemplated Change Notices and the Contract.

.3 Engage all necessary resources to provide competitive pricing for the proposed change in the Work.
.4 Work proactively with the Consultant to ensure that the submitted Contemplated Change Responses are complete.

1.4 PROCEDURE

.1 Upon considering a change in the Work the Consultant shall, under direction of the Owner, prepare a Contemplated Change Notice using Form 104. Any supporting information, drawings, sketches etc, will be included within the Contemplated Change Notice.

.2 Contemplated Change Notices and Responses, including supporting information, drawings and sketches, must be created in a clear and concise manner in an electronic format.

.3 Upon completion, the Consultant will sign the Contemplated Change Notice and subsequently issue the Contemplated Change Notice to the Owner for review and signing.

.4 The Owner will return the signed Contemplated Change Notice to the Consultant, upon which the Consultant will formally issue the Contemplated Change Notice to the Contractor.

.5 Upon receipt of a Contemplated Change Notice the Contractor shall review and acknowledge receipt of the Contemplated Change Notice by signing Form 104 as indicated, and returning the signed Contemplated Change Notice to the Consultant.

.6 The Contractor shall compile a Contemplated Change Response using From 105, to respond to the issued Contemplated Change Notice in accordance with their responsibilities listed above.

.7 Once compiled, the Contractor shall issue the Contemplated Change Response with a full breakdown of the pricing to the Consultant, with all supporting information attached (i.e. quotes, drawings, sketches etc).

.8 If the Contractor believes that an adjustment of the *Contract Time* is warranted, the proposed adjustment in the date of *Substantial Performance of the Work* shall be included within the Contemplated Change Response.

.9 Only Contemplated Change Notices that impact the agreed Critical Path associated with the Work shall be considered when proposing adjustments in the *Contract Time*.

.10 Acceptable costs and the overhead and profit amounts for both the Contractor and the Subcontractor, shall be applied in accordance with Section 01 26 63

.11 Upon receipt of the Contemplated Change Response, the Consultant shall review the completed package for completeness. Any further information that is deemed to be necessary to complete the review shall be requested in writing from the Contractor by the Consultant.

.12 Once a complete Contemplated Change Response has been compiled, the Consultant will review the information with the Owner, and reach a decision on whether to proceed with the proposed change in the Work.

.13 If the proposed change in the Work is to proceed, the Consultant will prepare and issue a Change Order in accordance with Section 01 26 63.

.14 If the proposed change in the Work is not to proceed, the Consultant will inform the Contractor of the decision in writing.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

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Form 104 – Contemplated Change Notice (C.C.N.)

7909 – 51 Avenue, Edmonton, AB T6E 5L9 T: 780.438.9000 F: 780.438.3700

Project Information

Project Name: _____ Project No.: _____

Client Name: _____ Contractor Name: _____

Contemplated Change Notice Information

C.C.O. Number: _____ Date of Issue: _____

C.C.O Title _____

Number of Pages: (Including Cover) _____

Related Specifications: _____

Related Drawings: _____

Attachments: _____

Contemplated Change Notice Addressed To

Name: _____

Company: _____

Contact Number: _____

Email: _____

Contemplated Change Notice Submitted By

Name: _____

Company: _____

Contact Number: _____

Email: _____

This is a Contemplated Change to the Contract for which an itemized quotation, including any impact on Contract Completion Date, is required. It does not constitute authority to proceed with the work below. All such work shall be carried out in accordance with the Contract Documents. A complete cost breakdown shall also be submitted for all affected subcontractors.

Description:

The Contractor shall not proceed with this work until an executed Change Order or Change Directive has been issued.

Recommended by the Consultant:

ISL Engineering and Land Services	Signature	Date

Approved by the Owner:

Client Representative	Signature	Date

ISL Engineering and Land Services

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Form 105 – Contemplated Change Response (CCR)

7909 – 51 Avenue, Edmonton, AB T6E 5L9 T: 780.438.9000 F: 780.438.3700

Project Information

Project Name: _____ Project No.: _____

Client Name: _____ Contractor Name: _____

Contemplated Change Response Information

CCR #: _____ Related CCN #: _____

CCR Date: _____ Response Required By: _____

CCR Description: _____

Attachments: _____

Number of Pages: (Including Cover) _____

Contemplated Change Response Addressed To

Name: _____

Company: _____

Contact Number: _____

Email: _____

Contemplated Change Response Submitted By

Name: _____

Company: _____

Contact Number: _____

Email: _____

Contemplated Change Response Details:

Total Cost of CCR including GST **$** _____

Extension to Contract Completion Date _____**Working Days**

The above CCR is open for acceptance for a period of 30 working days.

The Contractor shall not proceed with this work until an executed Change Order or Change Directive has been issued.

The Contractor Acknowledges that the price quoted for the above work includes all direct and indirect costs, including coordination of the work by signing this response.

Agreed to by the Contractor:

_____ Contractor Representative

_____ Signature

_____ Date

1 General

1.1 INTENT

.1 Define the workflow and documentation that is required to make application for payment at various stages of the project.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 CONDITIONS AND DEFINITIONS

.1 The application for payment as per Part 5 CCDC 5B shall be applied to this Contract.

.2 The application for payment shall conform and adhere fully to the Contract Documents.

.3 Item value is defined as the value of a specific task or activity as listed within the Bid Form.

1.3 SCHEDULE OF VALUES

.1 A Schedule of Values is to be developed in a spreadsheet format by the Contractor based upon Bid Form items and submitted to the Consultant for review.

.2 The Schedule of Values shall include columns for each item
- .1 The original Contract Price
- .2 The value previously claimed (amount ($) and percentage (%))
- .3 The value completed to-date (amount ($) and percentage (%))
- .4 The valued for the current period (amount ($) and percentage (%))

.3 Only approved and fully executed Change Orders shall be added as separate line items to the Schedule of Values and will be identified by the Consultants Change Order Number.

.4 Completion of the Schedule of Values for all heating, ventilation, process mechanical, electrical and instrumentation equipment shall be as follows:
- .1 Item supplied, delivered to and stored as per manufacturers recommendation on site: invoiced cost of item.
  - .1 Copy of invoice to be provided with payment application
- .2 Item installed: Maximum of 80% of the item value
- .3 Item installation verified, dry tested and wet tested in accordance with Section 01 70 00: Maximum of 90% of the item value
- .4 System commissioned and operating as intended: 100% of item value

1.4 APPLICATIONS FOR PROGRESS PAYMENT

.1 Applications for progress payment shall adhere to GC 5.4

1.5 SUBSTANTIAL PERFORMANCE OF THE WORK

.1 Applications for progress payment shall adhere to GC 5.5

1.6 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

.1 Payment of holdback upon Substantial Performance of the Work shall adhere to GC 5.6

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INTENT

.1 Define the minimum administrative and procedural requirements by which the Contractor shall coordinate the Work.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 LINES OF COMMUNICATIONS

.1 All communications between the Contractor and the Owner must include the Consultant with no exceptions.

.2 The Consultant and Owner have an agreement in place that gives the Consultant the authority to administer the Contract between the Owner and the Contractor. This authorised the Consultant to act on behalf of the Owner in accordance with the Contract Documents.

1.3 SUBMISSIONS FOLLOWING AWARD

.1 The Contractor shall submit for review to the Consultant, a minimum of 10 working days prior to the pre-construction meeting, the following:
- .1 Health and Safety Plan specific to the Place of Work in accordance with Section 01 35 29 Health, Safety and Emergency Response Procedures
- .2 ECO Plan specific to the Place of Work in accordance with Section 01 35 43 Environmental Procedures
- .3 Place of Work Layout Plan in accordance with Section 01 52 00 Construction Facilities
- .4 List of submittals to be reviewed by the Consultant throughout the duration of the Work (refer to Section 01 33 00 Submittal Procedures).

1.4 PLACE OF WORK

.1 Upon mobilizing to the Place of Work, the Contractor shall become fully responsible for all activities that occur within the Place of Work.

1.5 MOBILIZATION TO THE PLACE OF WORK

.1 Prior to mobilizing to the Place of Work,
- .1 Subject to Clause 1.4.2 within this Section the Consultant shall hold the pre-construction meeting and issue the record of the meeting.
- .2 Meet the requirements as detailed within Section 01 51 00 Temporary Utilities and Section 01 52 00 Construction Facilities.

1.6 PRIME CONTRACTOR

.1 Refer to Section 01 35 29 Health, Safety and Emergency Response Procedures.

1.7 MULTIPLE CONTRACTS

.1 If the Owner is executing multiple Contracts in close proximity to one another then the *Place of Work* for each Contract shall be clearly marked and separated.

.2 In the event that this is not possible and Contractor have to work within the same Place of Work, then whoever took responsibility for the Place of Work with regards to Prime Contract Status, shall retain this responsibility.

1.8 NOTIFICATION

.1 Prior to mobilization to the Place of Work, the Owner shall notify the local residents, businesses and stakeholders of the pending construction activities.

.2 For disruptive activities for which advanced notice can be provided (i.e. in excess of 7 calendar days), the Contractor shall inform the Owner who will notify the local residents, businesses and stakeholders.

.3 For disruptive activities for which minimal advanced notice can be provided (i.e. less than 7 calendar days), the Contractor shall notify the local residents, businesses and stakeholders.

1.9 ELECTRONIC RELEASE OF CADD FILES

.1 Upon request, electronic CADD Files may be released by the Consultant to the Contractor for use, once the Contractor has signed and returned a release form issued by the Consultant.

1.10 COORDINATION

.1 For activities that require the scheduling and the presence of a representative of either the Owner or the Consultant at the *Place of Work*, the Contractor shall provide a minimum of 2 weeks of notice in advance unless stated elsewhere in the Contract Documents

.2 The Contractor shall coordinate all shutdowns and interruptions to existing systems and services with the Consultant and perform shutdown work only at times acceptable to the Owner.

.3 All of the specifications and drawings are interpreted as one contract, including equipment supply contracts once any novation agreements are signed.

.4 The Contractor shall be wholly responsible for coordination of all work by own forces or subcontractors to complete the Work.

.5 No Section or Division of these specifications shall be construed or interpreted as being the responsibility of any subcontractor or supplier. Allocation of work scope to shall be solely the responsibility of the Contractor.

.6 The Contract Documents as developed by the Consultant define the design, function intent and requirements for key elements of the Work. This may be either specific or performance based.

.7 The Contractor shall be responsible for ensuring that the components of the design come together to result in a fully operable system as per the functional intent. This shall require the Contractor to coordinate the shop drawings with the Contract Drawings such that all components fit together and function as intended.
   .1 For example, in the situation where a skid mounted system is shown on the Contract Drawings, the Contractor shall coordinate the skid shop drawings with the Contract Drawings to ensure that all connection points are where they are shown on the Contract Drawings. In the situation where they are different, this difference needs to be indicated on the shop drawing submission such that the Consultant can provide input.
   .2 In the situation where multiple suppliers are indicated (e.g. valves and sluice gates) the Contractor shall coordinate the chosen supplier shop drawings with the Contract Drawings to ensure the chosen item can be installed in compliance with the Suppliers requirements. In the event where conflicts arise, the Contractor shall highlight the conflicts within the shop drawing submission.
   .3 Upon identification of any conflicts or issues, the Contractor shall notify the Consultant in a timely manner through the submission of an RFI in accordance with Section 01 26 13 Requests for Interpretation, such that the Consultant may establish the course of action.

.8 The Contractor shall examine the work of all trades and ensure that conditions are satisfactory for the completion of any subsequent work.

1.11 REFERENCE STANDARDS AND AGREEMENTS FOR THE WORK

.1 The most recent edition of the Owner's Engineering Design Standards, where available, shall apply to all work except as amended in the Contact Documents.

.2 Should any discrepancy or ambiguity arise between any of the clauses in the Owner's Engineering Design Standards, or amendments, and any clause in any other part of the Contract Documents, the requirements of the Contract Document shall apply.

1.12 ACCESS FOR OWNERS FORCES

.1 The Contractor shall plan, schedule coordinate and execute all work in the Place of Work as to minimize interferences with the existing infrastructure and its operation.

.2 The Contractor shall conduct Work while maintaining access for Owner's Operations Staff and any vehicles that are required for the ongoing operation of the facility (i.e. chemical deliveries, vac-truck etc.)

1.13 SURVEY AND LAYOUT

.1 In accordance with Section 01 32 23 Survey and Layout Data

1.14 TEMPORARY UTILITIES

.1 Refer to Section 01 51 00 Temporary Utilities

1.15 BUILDING PERMIT AND DEVELOPMENT APPROVALS

.1 Refer to Section 00 73 00 Supplementary Conditions

1.16 DOCUMENTS REQUIRED AT PLACE OF WORK

.1 The Contractor shall maintain at the Place of Work up to date hard copy versions of the following documents:
- .1 Contract drawings and specifications.
- .2 Contract addenda.
- .3 Reviewed submittals, including shop drawings.
- .4 Copies of all change documentation.
- .5 Copies of all permits
- .6 Copies of all field test reports.
- .7 Copy of current construction progress schedule.
- .8 Copies of all records of meetings
- .9 Copies of all health, safety and environmental documentation
- .10 Other documents as specified or requires in accordance with the Work.

.2 Project Record Documents in accordance with Section 01 70 00 Execution and Closeout Requirements.

1.17 NEW AND EXISTING PERMANENT UTILITY COORDINATION

.1 This clause applies to those Utilities which are controlled and management by third parties (i.e. ATCO, FORTIS, TELUS etc).

.2 The steps to the undertaken to coordinate permanent utilities prior to Contract Award shall be
- .1 The Consultant shall determine and define the necessary loads and required for the permanent utilities for the Work. This shall include, but is not limited to power, natural gas, sanitary, potable water and communications.
- .2 The Consultant shall show within the Drawings, the approximate location of the service provider's equipment (i.e. meters, transformers etc.) within the Place of Work. The final location and configuration shall be decided by the service provider.
- .3 Subsequently the Owner and Consultant shall prepare applications for service agreements which will be submitted to the service provider by the Owner.
- .4 The Owner will continue to review and adjust the application with the service provider with the support of the Consultant, until a final agreement is achieved.
- .5 Prior to issuing Contract Award, the Owner and service provider for each permanent utility shall have a signed service agreement in place.
- .6 All costs associated with this Clause and the services provided by the service providers shall be the responsibility of the Owner and shall be addressed under Section 01 21 00 Allowances.

.3 Subsequent to Contract Award
- .1 Using the signed service agreements as a basis, the Contractor shall coordinate the required steps to complete the modification, installation and commissioning of the permanent utilities.
- .2 The Contractor shall obtain all necessary information and specifications, to complete the modification / installation and ensure that the installed permanent utilities meets the requirements of the third party service provider.
- .3 Subsequent to issuance of the Building Permit, the Contractor shall ensure that all permits required to complete the installation are obtained by the Contractor. This includes, but is not limited to, electrical, gas and plumbing permits.
- .4 Prior to commencing the work to modify or install the permanent utilities the Contractor shall

.1 Confirm the utility connection location with the service provider's local representative, and
.2 Confirm the location of shallow utilities in accordance with Section 02 22 00 Existing Conditions Assessment

.5 The Contractor shall coordinate the inspections required to complete installation of the permanent utilities.
.6 Should the inspection identify deficiencies with the installation, the Contractor shall make corrections to the Work and coordinate subsequent inspections. The costs for this additional work shall be the responsibility of the Contractor.
.7 The Contractor shall work on behalf of the Owner to commission the permanent utilities.
.8 All costs associated with this Clause shall be the responsibility of the Contractor.

1.18 TRAFFIC ACCOMMODATION

.1 Where applicable, the Contractor shall develop a detailed Traffic Control Plan (TCP) that complies with the site specific Traffic Requirements showing construction staging, the limits of construction, type of construction activity, affected traffic lanes, and schedule.

.2 The TCP shall be submitted for review by the Consultant as per Section 01 33 00 Submittal Procedure, a minimum of 10 working days prior to the start of work that utilizes the TCP, or when a modification of the TCP is required.

.3 The TCP shall comply with the guidelines and preferred methods detailed in the most recent copy of Transportation Association of Canada (TAC)'s Manual of Uniform Traffic Control Devices for Canada.

.4 The TCP shall indicate all regulatory signs, warnings signs, barricades and lights proposed for use, as well as lanes of traffic maintained and direction of travel.

.5 The Contractor shall provide written notification to local businesses and residents directly affected by the TCP, stating what is happening to the roads and/or sidewalks at least 48 hours before commencement of the work that utilizes the TCP. A minimum of 7 working days' notice must be provided if roads and / or sidewalks are to be closed. The notice shall include the Contractor's company name, the contact details and phone number for the person in charge of the Work, as well as a description of what work is taking place. The notice will also include the start date, and estimated duration of the scope of work that utilizes the TCP.

.6 A draft notice shall be submitted to the Consultant for review as per Section 01 33 00 Submittal Procedure, a minimum of two working days prior to when the notice must be circulated.

.7 The Contractor shall provide and maintain access to all public and private parking for the duration of the Work.

.8 The Contractor shall keep travelled ways graded, free of pot holes and of sufficient width for required number of lanes of traffic.

.9 Continually maintain traffic control devices in use by:
.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

.10 The Contractor shall provide and maintain paved detours or temporary roads for the duration of the scope of work that utilizes the TCP.

.11 The Contractor shall notify all emergency agencies and any affect third parties of any road closures or detours that occur as a result of the Work.

.12 The Contractor shall provide competent flag person, properly equipped as specified in the manual of Uniform Traffic Control Devices for Canada, in the following situations:
- .1 When public traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.
- .2 When it is necessary to institute a one-way traffic system through the construction area or other blockage where traffic volumes are heavy, approach speeds are high or a traffic signal system is not in use.
- .3 In situations where workers or equipment are working in areas of limited visibility to traffic or at other locations where oncoming traffic would not otherwise have adequate warning.
- .4 For emergency protection when other traffic control devices are being erected or taken down.
- .5 For emergency protection when other traffic control devices are not readily available.
- .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.13 All costs for preparing, executing, maintaining and removing the TCP including provisions of signs and coordination with governing authorities shall be included within the Contract Price.

1.19 THIRD PARTY TESTING

.1 This clause applies to the performance of quality control testing performed by third party testing agencies to verify the quality of the Work.

.2 The costs associated with third party testing services shall be addressed through Cash Allowances as per Section 01 21 00 Allowances

.3 The responsibilities with respect to third party testing are
- .1 The Contractor shall at the preconstruction meeting, propose the parties who they intend to use for all third party testing as defined within the Contract.
- .2 The final decision as to which parties shall be used for third party testing and their performance with respect to the Work, shall be the responsibility of the Contractor.
- .3 The Contractor and third party who will undertake the testing, shall enter into an agreement to provide the services required as detailed within the Contract.
- .4 The Contractor shall coordinate all testing activities that are required as part of the Work.
- .5 Should the third party testing agency be unable to undertake testing when mobilized to site due to the Work not being ready for testing, the Contractor shall be responsible for the cost of the wasted effort.
- .6 The results of the testing shall be provided in a clear and legible, electronic format to the Consultant within a timely manner.

1.20 WASTED EFFORT BY CONSULTANT

.1 As part of the Work, the Contractor shall request that the Consultant mobilize to the Place of Work to undertake specific tasks. These tasks can include, but are not limited to, witnessing of testing, site reviews, verification and testing, performance testing, acceptance testing and monitoring of force account work.

.2 Should the Consultant mobilize to the Place of Work and the Work is not fully ready to undertake the specific task, the Contractor shall reimburse the Owner for the Consultant‘s wasted effort.

.3 With regards to the Consultant’s activities, wasted effort is defined as
- .1 Time spent and costs incurred travelling to the Place of Work for specific task, when the Work is not fully ready.
- .2 Time spent on site, waiting for activities to be completed such that the Consultant can complete specific tasks (i.e. stand-by time).

.4 The wasted effort shall be noted by the Consultant using Form 107, and submitted to the Contractor and the Owner as a written record within 24 hours of being identified.

.5 Following submission of the record to the Contractor, the Consultant shall add the actual costs (time and disbursements) of the wasted effort to the Contract’s Deficiency List.

1.21 DEFICIENCY LIST

.1 At the discretion of the Consultant a deficiency list will be started.

.2 The deficiency list shall be owned and managed by the Consultant.

.3 The deficiency list will be reviewed and updated at each progress meeting once started

.4 Each deficiency will be assigned a cost by the Consultant, which shall be based upon the Consultant’s estimate of the level of effort required by 3rd parties to mobilize and rectify the identified deficiency. In order to account for unknown factors and risk, the Consultant shall be permitted to apply a significant safety margin (markup) to the estimated costs.

.5 As each line item is progressed within the Schedule of Values, the Consultant may at their discretion, start to apply and withhold deficiency values in excess of the amounts yet to be progressed such that a sufficient deficiency fund can be established.

.6 When a noted deficiency has been addressed the Contractor shall inform the Consultant that the noted deficiency is ready for a field review to verify rectification.

.7 At the earliest opportunity the Consultant shall complete a field review of the noted deficiency and shall adjust and update the deficiency items as appropriate.

.8 As part of each progress payment process the contents and value of the deficiency list shall be reviewed by the Consultant and the balance released to the Contractor.

.9 Failure to submit any documentation, certificates, sign-offs, drawings or manuals can be classified as a deficiency and a deficiency value withheld.

.10 In order to achieve Total Performance of the Work, all the identified deficiencies must be rectified in accordance with the Contract Documents.

1.22 PROJECT RECORD DOCUMENTS

.1 In accordance with Section 01 70 00 Execution and Closeout Requirements

1.23 PROJECT MEETINGS

.1 Preconstruction Meeting
- .1 Within ten (10) days after award of Contract, the Consultant will request a preconstruction meeting of parties within the Contract to discuss and resolve administrative procedures and responsibilities. The preconstruction meeting will be held in proximity to the place of Work.
- .2 Representatives of the Owner, Consultant, Contractor, and Major Subcontractors shall be in attendance. Subcontractors specifically requested to attend by the Consultant will be in attendance.
- .3 Representatives of the Owner, Consultant, Contractor, and Major Subcontractors must be qualified and authorized to act on behalf of the party that each represents.
- .4 After time and location of this meeting has been established, the Consultant shall notify all parties concerned and provide a meeting agenda, a minimum of five (5) days before the meeting.
- .5 The Consultant shall chair and record discussions and decisions, and circulate the record of meeting to all parties concerned.
- .6 The Contactor shall make submissions to the Consultant prior to the preconstruction meeting in accordance with this Section, Clause 1.4
- .7 The preconstruction meeting agenda shall include the following items:
  - .1 Appointment of official representatives of participants in the Work
    - .1 Communication protocol and contact information.
    - .2 Emergency contact numbers / protocol
  - .2 Contract Requirements
    - .1 Bonds, Insurance, Worker's Compensation Board, Municipal Business License
    - .2 Project milestones
  - .3 Contract drawings and specifications
    - .1 Issued for construction
    - .2 Execution of Contract Documents
  - .4 Construction progress schedule
    - .1 Key equipment delivery schedule
  - .5 Construction progress reporting and meetings
  - .6 Document submittals process
    - .1 Shop drawings, samples, RFIs, test certificates etc
    - .2 Long delivery items
  - .7 Payment procedures and lien holdbacks
  - .8 Management of deficiencies and fund
  - .9 Access to the Place of Work
    - .1 Owner’s requirements (personnel, chemical deliveries etc.)
  - .10 Existing Conditions Assessment
  - .11 Requirements for temporary facilities
    - .1 Site layout, site sign, offices, storage sheds, weather protection, utilities, fences, site security
  - .12 Health, safety and environmental requirements and procedures
    - .1 Designation of prime contractor
  - .13 Appointment of inspection and testing agencies or firms
  - .14 Survey requirements

.1 Design controls points, electronic information, survey for record drawings & GIS.

.15 Changes to the work
.1 Terminology, definitions and procedure

.16 Project record documents

.17 Verification and Testing
.1 Roles and responsibilities
.2 Operation and maintenance manuals
.3 Checklists and sign-offs

.18 Performance Testing
.1 Roles and Responsibilities
.2 Commissioning Plan
.3 Commissioning Report and sign offs

.19 Acceptance Testing
.1 Roles and Responsibilities
.2 Acceptance Meeting

.20 Substantial Performance of the Work following Acceptance Testing

.21 Total Performance of the Work

.22 Warranty period and expiry of warranty

.23 Any other business

.24 Next Meeting.
.1 Construction Progress Meeting Schedule

.2 Construction Progress Meetings

.1 Construction progress meetings will be held every two weeks during construction and every week during the final two months of construction and through commissioning. This frequency can be adjusted at the discretion of the Consultant.

.2 The schedule for the construction progress meetings shall be agreed to by the Owner, Consultant and Contractor at the preconstruction meeting.

.3 Construction progress meetings will be held either in proximity to the place of Work or virtually via video conference calling.

.4 Representatives of the Owner, Consultant, Contractor, and major Subcontractors shall be in attendance. Subcontractors specifically requested to attend by the Consultant will be in attendance.

.5 Representatives of the Owner, Consultant, Contractor, and major Subcontractors must be qualified and authorized to act on behalf of the party that each represents.

.6 After time and location of this meeting has been established, the Consultant shall notify all parties concerned and provide a meeting agenda.

.7 The Consultant shall chair and record discussions and decisions, and circulate the record of meeting to all parties concerned.

.8 The Contactor shall ensure that all construction progress documentation submissions are current as per Section 01 32 00, prior to the construction progress meeting.

.9 The Contractor shall bring to the construction progress meetings a current construction progress schedule in accordance with Section 01 32 00.

.10 As a minimum the following items will be reviewed and discussed at the construction progress meeting. These items will form the basis of the agenda.
.1 Safety.
.2 Acceptance of previous record of meeting.
.3 Sustainability.
.4 Construction Coordination.
.5 Schedule.

.6 Materials Testing.
.7 Submittals.
.8 Changes to the Contract.
.9 Progress Payments.
.10 Commissioning.

.3 Site Coordination Meetings
.1 Meetings will be held every week via conference call to coordinate site specific activities.
.2 The meeting will be attended by the Owner, Consultant and Contractor, and will include the Contractor's Site Supervisor / Foreman.
.3 This frequency can be adjusted at the discretion of the Consultant.
.4 Subcontractors specifically requested to attend by the Consultant will attend.
.5 The Consultant shall chair and record discussions and decisions, and circulate the assigned actions to all parties concerned.

.4 Additional Meetings
.1 For meeting requirements in association with start-up, commissioning, acceptance and close out of the Work refer to Section 01 70 00 Execution and Closeout Requirements.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

ISL Engineering and Land Services

Inspiring sustainable thinking

Form 107 – Force Account Sheet
(To Record Consultant's Time and Costs)

7909 – 51 Avenue, Edmonton, AB T6E 5L9 T: 780.438.9000 F: 780.438.3700

Project Information

Project Name: _____ Project No.: _____

Client Name: _____ Contractor Name: _____

Force Account Information

Date of Force Account Sheet: _____

Force Account Reference: _____

Force Account Work Description:

_____

Force Account Sheet Addressed To

Name: _____

Company: _____

Contact Number: _____

Email: _____

Force Account Sheet Submitted By

Name: _____

Company: _____

Contact Number: _____

Email: _____

_____ _____

ISL Representative Signature Contractor Representative Signature

ISL Engineering and Land Services

Inspiring sustainable thinking

Form 107 – Force Account Sheet
(To Record Consultant's Time and Costs)

Labour Description

Name of Worker	Classification of Worker	Labour Rate ($/hr)	Number of Hours	Total Cost
		$		$
		$		$
		$		$
		$		$
		$		$
		$		$

Material and Equipment Description

Description	Unit Rate	Number of Units	Total Cost
	$		$
	$		$
	$		$
	$		$
	$		$

Labour	$
Material and Equipment	$
Total Cost	$

1 General

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work and at the call of Consultant.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Consultant.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and affected parties not in attendance.

.8 Representative of Contractor, subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING (CONSTRUCTION PARTNERING WORKSHOP)

.1 Within 30 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Representatives of Owner, Consultant, Contractor, major subcontractors, suppliers listed in bid form, field inspectors and supervisors will be in attendance.

.3 Coordinate time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Agenda to include:

- .1 Appointment of official representative of participants in the Work.
- .2 Schedule of Work: in accordance with Construction Progress Schedules.
- .3 Schedule of submission of shop drawings, samples, and colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
- .5 Delivery schedule of specified equipment.
- .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .8 Owner provided products and salvaged items as indicated on drawings.
- .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work schedule progress meetings every two weeks.

.2 Contractor, major subcontractors involved in Work, Consultant, and Owner are to be in attendance.

.3 Notify parties' minimum 5 days prior to meetings.

.4 Consultant will record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.5 Agenda to include the following:

- .1 Review, approval of minutes of previous meeting.
- .2 Review of Work progress since previous meeting.
- .3 Field observations, problems, conflicts.
- .4 Problems which impede construction schedule.
- .5 Review of off-site fabrication delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INTENT

.1 Define the information and documentation that shall be submitted to the Consultant as defined to substantiate applications for progress payment and the completion of the Work.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 CONSTRUCTION PROGRESS SCHEDULE

.1 Prepare a time scaled chart which shows the sequence of activities to complete the Work using critical path methodology (i.e. tracking Gantt chart). This detailed schedule will provide the basis for
- .1 Determining the status of the project relative to the specified milestones dates.
- .2 Determining the acceptability of the Contractor's application for payment.
- .3 Any claims for delay in accordance with GC 6.5.

.2 Construction Progress Schedule shall show
- .1 All construction activities, such that the steps needed to complete the Work are clearly communicated.
- .2 Procurement activities for items that affect the critical path.
- .3 Items of coordination with the Consultant and Owner. These include, but are not limited to,
  - .1 Mobilization and demobilization
  - .2 Approvals and permitting
  - .3 Delivery of operation and maintenance manuals
  - .4 Verification and Testing
  - .5 Demonstration and training
  - .6 Commissioning
  - .7 Performance testing
  - .8 Substantial performance of the work
  - .9 Total Performance of the Work
- .4 For each activity the following dates shall be clearly identified by dd-mm-yyyy,
  - .1 Planned start date
  - .2 Planned end date
  - .3 Actual start date
  - .4 Actual end date
- .5 Items that affect the substantial performance date shall be identified through the critical path.

.3 The format of the Construction Progress Schedule submission shall be:
- .1 Provided in an electronic format (.PDF). Scanned documents are not acceptable, and the Construction Progress Schedule shall be printed to PDF directly from the software used to generate the schedule.
- .2 Printable and legible on 11” by 17” paper, with a landscape orientation and a timescale that is reasonable for display and discussion.

.3 Coloured, with the baseline, critical path, work completed, ongoing work (as a percentage of completion) and future work identified as different distinct colours.

.4 Within the Preconstruction Meeting, the Contractor shall present their developed Construction Progress Schedule to complete the Work in accordance with the noted requirements. Upon review and the provision of comments by the Consultant and Owner, the Contractor shall undertake the necessary revisions and resubmit to the Consultant and Owner for further review.

.5 Upon confirmation that the Consultant and Owner have no further comments, the submitted schedule shall become the project baseline. All further updated submissions of the construction progress schedule shall be compared to this baseline, such that variances in the critical path can be identified.

1.3 CONSTRUCTION CASH FLOW SCHEDULE

.1 Prepare a construction cash flow schedule based upon the current construction progress schedule that estimates the value of the monthly applications for progress payment. This construction cash flow schedule will facilitate the Consultant and Owner in establishing an overall project cash flow schedule.

.2 Construction cash flow schedule shall
- .1 Include the items listed within the Schedule of Values
- .2 Be based upon a monthly timescale.

.3 The format of the construction cash flow schedule submission shall be
- .1 Provided in an electronic format (.PDF). Scanned documents are not acceptable, and the construction cash flow schedule shall be printed to PDF directly from the software used to generate the schedule.
- .2 Printable and legible on 11” by 17” paper, with a landscape orientation.

.4 Within the Preconstruction Meeting, the Contractor shall present their developed construction cash flow schedule to complete the Work in accordance with the noted requirements. Upon review and the provision of comments by the Consultant and Owner, the Contractor shall undertake the necessary revisions and a resubmit to the Consultant and Owner for further review.

.5 All further updated submissions of the construction cash flow schedule shall be adjusted to include actual monthly applications for progress payment to date per item and a reforecast of all future monthly applications for progress payment, which shall reflect the current updated construction progress schedule.

1.4 CONFIRMATION SUMMARY OF HEALTH AND SAFETY ACTIVITIES

.1 Prepare a confirmation summary of health and safety activities, which confirms that the health and safety obligations of the Prime Contractor Role have been completed. This will facilitate the Consultant’s and Owner’s ability to confirm that the requirements of the federal and provincial Health and Safety Legislation are being adhered to.

.2 The confirmation summary of health and safety activities shall include as a minimum,
- .1 Confirmation of what health and safety tasks and activities have been undertaken, within the following areas where applicable,
  - .1 Updated Safety Manual

.2 Project Hazard Assessment
.3 Daily Hazard Assessment
.4 Toolbox Talks
.5 Site Safety Inspections
.6 Incident Reporting
.7 Equipment Inspections and Certifications
.8 Required Training Records (Fall Protection, First Aid)
.9 Emergency Response Plans
.10 Safe Work Practices and Procedures
.11 Lift Plans
.12 MSDS binders available and updated
.13 Hot Work Permits
.14 Confined Space Monitoring

.2 The time period to which the tasks and activities included within the summary above apply
.3 Be signed and dated by the Contractor's Project Manager

.3 The submission of the confirmation summary of health and safety activities shall be
.1 Provided in an electronic format (.PDF). Scanned documents are not acceptable, and the confirmation summary shall be printed to PDF directly from the software used to generate the document.
.2 Printable and legible on letter sized paper, with a portrait orientation.

.4 Submission of the confirmation summary of health and safety activities will commence once the Work on site begins.

.5 The reporting period for the confirmation summary of health and safety activities will correspond to the same time periods as payment applications

1.5 PROGRESS REPORTING

.1 Prepare on a weekly basis a progress report for submission to the Consultant and Owner. This weekly report will form the basis of discussions at the construction progress meeting and weekly updated meetings.

.2 The progress report shall as a minimum,
.1 Be a simple table or bulleted list that communicates the key information with regards to the following topics.
.1 Status of construction / work completed
.2 To be completed this week
.3 Key issues that will affect schedule
.4 Key deliveries made last week and expected this week
.5 Safety Issues / Incidents Reported
.6 Coordination Items with Consultant and Owner
.2 Photographs of the work which illustrate the status of the Work at the time of submission.

.3 The progress report submission shall be:
.1 Provided in an electronic format (.PDF). Scanned documents are not acceptable, and the progress report shall be printed to PDF directly from the software used to generate the document.
.2 Printable and legible on Letter paper, with a portrait orientation.

.4 Submission of the weekly progress reports will commence once the Work on site begins.

.5 Each weekly submission of the progress report, shall be made the day prior to the weekly update meeting, such that the Consultant and Owner has sufficient time to review the report.

.6 Applications for Progress Payment will not be certified until all weekly progress reports for the payment period have been submitted and reviewed by the Consultant and Owner.

1.6 PROGRESS PHOTOGRAPHS

.1 Prior to commencing the Work note and record the condition of the Place of Work as per Section 02 22 00 Existing Conditions Assessment

.2 At weekly intervals thereafter, or at the direction of the Consultant, provide the Consultant and Owner with a digital photographic record of the Work.

.3 Within the photographic submission clearly show relevant progression of the Work, from both an exterior and interior perspective.

.4 Photographs shall be in digital format (JPEG) with 200 dpi resolution as a minimum.

.5 Site photographs shall be submitted to the Consultant and Owner either by
.1 Email as a file attached to the email or
.2 A File Transfer Protocol (FTP) which alerts the recipient by email.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Consultant to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to Consultant within 15 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

1.4 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

- .1 Award.
- .2 Shop Drawings, Samples.
- .3 Permits.
- .4 Mobilization.
- .5 Excavation.
- .6 Backfill.
- .7 Building footings.
- .8 Slab on grade.
- .9 Structural Steel.
- .10 Siding and Roofing.
- .11 Interior Architecture (Walls, Floors and Ceiling).
- .12 Plumbing.
- .13 Lighting.
- .14 Electrical.
- .15 Piping.
- .16 Controls.
- .17 Heating, Ventilating, and Air Conditioning.
- .18 Millwork.
- .19 Fire Systems.
- .20 Testing and Commissioning.
- .21 Supplied equipment long delivery items.
- .22 Engineer supplied equipment required dates.

1.5 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule every two weeks reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INTENT

.1 Clarify and assign responsibility for initial survey and layout of the Work, and the ongoing verification of the installed Work through to completion.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 RESPONSIBILITIES

.1 Consultant Responsibilities:
- .1 To provide the coordinate system and the location of the control points used for the design in a useable format.

.2 Contractor Responsibilities:
- .1 To engage a qualified surveyor to meet the requirements of the Contract.
- .2 To complete survey work in accordance with the Contract Documents. This may include, but is not limited to provision of control points for the Work, verification of existing conditions, layout of the Work for construction, collection of record information and measurement of quantities when required.
- .3 To ensure that the point code descriptions to be used for the Work is approved by the Consultant prior to commencing survey.

1.3 QUALIFICATIONS OF SURVEYOR

.1 The Contractor’s Surveyor shall be a registered member of the Alberta Land Surveyors’ Association (ALS).

1.4 SURVEY INFORMATION FORMAT

.1 All survey information shall be transferred between Consultant and Contractor and vice-versa in a NAD83, 3TM 114, Grid projection.

.2 The transfer of information between Contractor and Consultant will be through an ASCII file format (CSV or TXT file).

.3 The release of the electronic survey files are for convenience only and the Consultant shall not be held liable for the completeness or correctness of the electronic files transmitted.

.4 Survey files shall be provided upon request, via signed electronic release and indemnity form.

.5 The Contractor's responsibility for the layout and survey control of the Work is not relieved by the provision of electronic survey files in terms of any deviations, errors or omissions within. It is the Contractors responsibility to check and verify the survey information within the Place of Work.

1.5 SURVEY CONTROL POINTS

.1 Existing base horizontal and vertical control points are designated within Contract Documents and/or within an electronic copy of the original survey data, which will be provided by the Consultant.

.2 The Contractor shall locate, confirm and protect legal control points. Should legal control points or monuments be damaged during construction, the Contractor shall at their own cost, repair the legal control points or monuments to the local requirements.

1.6 CONTROL LAYOUT FOR THE WORK

.1 The Contractor shall establish and maintain a control layout system for the performance of the Work.

1.7 INITIAL LAYOUT

.1 The Contractor shall be responsible for the layout of the work using the control layout system established above.

.2 If survey conditions are found to vary substantially from those noted within the Contract Documents, notify the Consultant in writing in a timely manner.

1.8 SURVEY OF ONGOING WORK

.1 Throughout the execution of the Work, the Contractor shall verify the installation coordinates and elevations of key aspects. This includes but is not limited to,
- .1 Inverts and rim elevations of manholes
- .2 Inverts of below ground pipework upon entry or exit of structures, or when a change in direction or grade occurs
- .3 Below ground pipework valves and appurtenances
- .4 Invert elevations and locations for channels, culverts and drainage swales.
- .5 Top elevations of all slabs
- .6 Portions of the work that will be buried, covered or submerged such that final survey is not possible, including capped services and Utilities.

.2 All information captured as part of the survey of ongoing work shall be clearly recorded upon the redline markup drawings.

1.9 FINAL SURVEY

.1 Upon completion of all surface aspects of the Work to the finished grade, the Contractor shall complete and provide the Consultant with a final topographic survey of the Work.

.2 Survey to include break lines within the topography (any change in grade or material).

.3 Approved point code descriptions shall be provided within the ASCII file.
- .1 Alternatively with prior approval from the Consultant, a 3D model in CAD Civil 3D may be provided by the Contractor to the Consultant

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 ADMINISTRATIVE

.1 Submit to Consultant submittals listed for review. 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 Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated 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 Consultant 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 co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Refer to CCDC 2 GC 3.10.

.2 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.

.3 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Alberta, Canada.

.4 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.5 Allow 10 working days for Consultant's review of each submission.

.6 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.7 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.

.8 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.

.9 Submissions include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 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 Consultant's review, distribute copies.

.11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.12 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.13 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Consultant.
- .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 accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.

.14 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.
- .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.

.15 Submit electronic copies of manufacturer’s instructions for requirements requested in specification Sections and as requested by Consultant.
    .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.

.16 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.
    .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

.18 Delete information not applicable to project.

.19 Supplement standard information to provide details applicable to project.

.20 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies 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.

1.3 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 Consultant's address.

.3 Notify Consultant 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 Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.6 Make changes in samples which Consultant 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.

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.5 PHOTOGRAPHS: DIGITAL FORMAT

.1 Progress Photographs
    .1 Sizes: minimum 1 mega pixel image file size, jpeg image file.
    .2 Format: CD or DVD (*.jpg).

.3 Viewpoints: A minimum of four (4) photographs from three (3) different viewpoints will be required.
.4 Number of photo sets: one (1) set per month.
.5 Identification: referenced to photo file with name, location, purpose, and number of project and date of exposure.
.6 Viewpoints: interior and exterior locations: viewpoints determined by Consultant.
.7 Frequency: at completion of excavation, foundation, framing, and services before concealment and at completion of each discrete phase of construction.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INTENT

.1 The intent of Delegated Design Submittals required by this section is to account for professional engineering responsibility for design, review and acceptance of components of Work forming a part of permanent Work in accordance with Building Code, and that has been assigned to a design entity other than Consultant including, but not limited to, the following:

- .1 Design requiring structural analysis of load bearing components and connections.
- .2 Design requiring compliance with fire safety regulations.
- .3 Design requiring compliance with life or health safety regulations.

.2 This section provides standard forms for submittal of Letter of Commitment and Letter of Compliance required complying with requirements of Building Code and design delegated to a professional Engineer within technical specification sections.

.3 Delegated Design Submittals are not required for components of Work requiring engineering for temporary Work (i.e.: crane hoisting, engineered lifts, false Work, shoring, concrete formwork) that would normally form a part of Contractor's scope of Work.

.4 The requirements of this section are in general conformance with recommended Responsibilities for Engineering Services for Building Projects published by Association of Professional Engineers, Geologists and Geophysicists of Alberta (APPEGA), with regards to duties of specialty professionals appointed during construction period.

.5 The requirements of this section do not diminish responsibilities of Consultant's role as Registered Professional of Record; submittals will be used by Consultant to establish that Work is substantially performed in accordance with Building Code.

1.2 DELEGATED DESIGN

.1 Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated where professional design services or certifications by a design professional are specifically required of Contractor by Contract Documents.

.2 If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Consultant.

.3 Delegated design will be required for elements designed by a specialty professional, which may include:

- .1 Elements normally fabricated off-site
- .2 Elements that require specialized fabrication equipment or a proprietary fabrication process not usually available at job site (i.e.: open web steel joists, wood trusses, combination wood and metal or plywood joists, prefabricated wood or metal buildings, noise and vibration isolation devices, elevators).
- .3 Elements requiring civil engineering, not normally a part of scope of services performed by architectural; structural; mechanical; electrical; or geotechnical disciplines of Consultant.

2 Products

2.1 LETTER OF COMMITMENT

.1 Submit a signed and sealed Letter of Commitment on company letterhead addressed to Consultant in accordance with format in Appendix A attached to the end of this Section prior to starting Work requiring design and seal of a professional engineer.

2.2 LETTER OF COMPLIANCE

.1 Submit a signed and sealed Letter of Compliance on company letterhead addressed to Consultant in accordance with format in Appendix B attached to the end of this Section on completion of Work requiring design and seal of a professional engineer.

3 Execution

3.1 IMPLEMENTATION

.1 Include summary of Work described in technical specification section as a part of the required Letter of Commitment.

.2 Prepare required submittals and present to Consultant within sufficient time to allow for Consultant's detailed review and acceptance.

.3 In lieu of Items 2.1 and 2.2, Alberta Building Code Compliance Schedules A, B, and C will be accepted.

END OF SECTION

APPENDIX A

LETTER OF COMMITMENT

Submit a signed and sealed letter of commitment on company letterhead in the form as follows:

[Date]

[Consultant]
[Consultant's Address]

Attention: [Consultant's Registered Professional of Record]

Re: Letter of Commitment for Delegated Design of [System of Component of Work]
[Name of Project]
[Project Number]
[City, Province]

As the retained registered professional engineer for design and field review of the above named component of Work and project, I hereby give assurance I am qualified to perform the following Work as required by Contract Documents:

1. [List appropriate design services for System or Component of Work];
2. Preparation of shop and erection documents;
3. Review fabrication of [structural] [fire rated] [life and health safety] components;
4. Review erection of [structural] [fire rated] [life and health safety] components.
5. [Modify list to suit System of Component of Work.]

I hereby give assurance that I will be responsible for above noted Work as described in Section [?????] – [Name of Section] of Project Manual, including requirements of addenda, change orders and change directives.

I also undertake to be responsible for field review of fabrication and erection of [structural] [fire rated] [life and health safety] components as required to ascertain substantial compliance with the Building Code and Contract Documents.

I will notify you in writing if my responsibility is terminated at any time during the course of Work covered by this Letter of Commitment.

Retained Professional Engineer

_____
Signature

_____
Date
(Apply seal)

APPENDIX B

LETTER OF COMPLIANCE

[Date]

[Consultant]
[Consultant's Address]

Attention: [Consultant's Registered Professional of Record]

Re: Letter of Compliance for Delegated Design of [System of Component of Work]
[Name of Project]
[Project Number]
[City, Province]

I hereby give assurance that I have fulfilled my obligations for field review as outlined by previously submitted Letter of Commitment.

I hereby give assurance that aspects of [structural] [life and health safety] Work as defined by previously submitted Letter of Commitment substantially comply with Contract Documents and Building Code.

Retained Professional Engineer

_____
Signature

_____
Date
(Apply seal)

1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.3 Province of Alberta
- .1 Occupational Health and Safety Code, 2021

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
- .1 Results of site specific safety hazard assessment.
- .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Consultant and authority having jurisdiction, weekly.

.4 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets.

.7 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Consultant within 7 days after receipt of comments from Consultant.

.8 Consultant's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Consultant

.10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

.11 Submit health and safety inspection report electronically, monthly with progress claim.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with Consultant and Owner prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act of Alberta.

1.10 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

- .1 Have site-related working experience specific to activities.
- .2 Have working knowledge of occupational safety and health regulations.
- .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.12 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Consultant.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.

.2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Consultant.

1.15 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Consultant.

1.16 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Consultant Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

1.3 FIRES

.1 Fires and burning of rubbish on site not permitted.

1.4 DISPOSAL OF WASTES

.1 Strictly adhere to requirements of Section 01 74 21 Waste Management and Disposal. Do not bury rubbish and waste materials on site unless approved by Consultant.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.5 DRAINAGE

.1 Provide erosion and sediment control plan that identifies type and locations of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measure are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.3 Do not pump water containing suspended materials into waterways or drainage systems. Migration to water retention pond is allowed.

.4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.6 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated on Drawings and in Specifications.

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Restrict tree removal to areas indicated or designated by Consultant.

1.7 WORK ADJACENT TO WATERWAYS

.1 Do not operate construction equipment in waterways.

.2 Do not use waterway beds for borrow material.

.3 Do not dump excavated fill, waste material or debris in waterways.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.7 Do not blast under water or within 100 m of indicated spawning beds.

1.8 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.9 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.

.3 Consultant will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code - 2019 Alberta Edition, including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

- .1 Contract documents.
- .2 Specified standards, codes and referenced documents.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INSPECTION/FIELD REVIEW

.1 Refer to CCDC 5B, GC 2.3.

.2 Allow Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or law of Place of Work.

.4 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.5 Consultant will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Consultant shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Coordinate with an approved Independent Inspection/Testing Agencies for purpose of inspecting and/or testing portions of Work. Cost of such services are provided for by Cash Allowance.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection or testing, appointed agency will request additional inspection or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and re-inspection. These costs are not recoverable by any Cash Allowance provision.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

.1 Notify appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REPORTS

.1 Submit electronic copies of inspection and test reports to Consultant.

.2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.6 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Consultant and may be authorized as recoverable.

1.7 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Construct in locations acceptable to Consultant or as specified in specific Section.

.3 Prepare mock-ups for Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups 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.

.5 If requested, Consultant will assist in preparing schedule fixing dates for preparation.

.6 Remove mock-up at conclusion of Work or when acceptable to Consultant.

.7 Mock-ups may remain as part of Work.

.8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.8 MILL TESTS

.1 Submit mill test certificates as requested or required of specification Sections.

1.9 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.2 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.3 WATER SUPPLY

.1 Provide continuous supply of potable water for construction use.

.2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

.3 Pay for utility charges at prevailing rates.

1.4 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters, replace bearings, and clean system.

.8 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.

.9 Pay costs for maintaining temporary heat, when using permanent heating system.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
- .1 Conform to applicable codes and standards.
- .2 Enforce safe practices.
- .3 Prevent abuse of services.
- .4 Prevent damage to finishes.
- .5 Vent direct-fired combustion units to outside.

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.5 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

.3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

.5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.6 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, and data hook up, lines and equipment necessary for own use.

1.7 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
- .1 CCDC 2-08, Stipulated Price Contract.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.3 Canadian Standards Association (CSA International)
- .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete, Includes Updates through No. 3 August 2006.
- .2 CSA-0121-08, Douglas Fir Plywood.
- .3 CAN/CSA-S269.2-M87(R2003), Access Scaffolding for Construction Purposes.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.4 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.

1.5 HOISTING

.1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists cranes to be operated by qualified operator.

1.6 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.7 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to project site.

.3 Clean runways and taxi areas where used by Contractor's equipment.

1.8 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays as required.

.2 Provide fencing and additional security as deemed necessary.

1.9 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings to seat 10 persons and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.11 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Consultant.

1.12 CONSTRUCTION SIGNAGE

.1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Consultant. The contractor shall submit a shop drawing for review prior to fabrication of the sign. The sign shall include the following:

1. Owner’s Emblem
2. Engineer’s logo
3. Name of project

4. Contact details for the Owner and the Contractor

.2 No other signs or advertisements, other than warning signs, are permitted on site.

.3 Locate project identification sign as directed by Consultant.

.4 Maintain approved signs and notices in good condition for duration of project and dispose of offsite on completion of project or earlier if directed by Consultant.

1.13 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

2 Products

2.1 NOT USED

3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
- .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)
- .1 CSA-O121-08, Douglas Fir Plywood.

.3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosure using purpose made, prefabricated interlocking metal fence panels 2.1 m high.

.2 Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.3 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.4 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide as required by governing authorities and as indicated.

1.5 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.6 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.8 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Consultant locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
  .1 CCDC 5B

.2 Within text of each specifications section, reference may be made to reference standards.

.3 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.4 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.

.5 Cost for such testing will be borne by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Refer to CCDC 5B.

.2 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.3 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.

.4 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.

.5 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.

.6 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.7 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.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant 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 Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 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.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.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 Remove and replace damaged products at own expense and to satisfaction of Consultant.

.9 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

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

1.6 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 Consultant in writing, of conflicts between specifications and manufacturer's instructions.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 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 Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Consultant 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 Consultant, whose decision is final.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform Consultant if there is interference. Install as directed by Consultant.

1.10 REMEDIAL WORK

.1 Refer to CCDC 5B and Section 01 73 00 - Execution Requirements.

.2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.12 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.

1.13 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.

1.14 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Consultant.

1.15 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/or building occupants 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.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 INTENT

.1 This section indicates the criteria for use of optional products listed in the specification and provision for proposing changes to acceptable materials listed during the Bid Period and during construction.

1.2 DEFINITIONS

.1 Acceptable Materials: The term Acceptable Materials is used to specify products by trade name, manufacturer, catalogue number, model number, or similar reference, and is used within the Project Manual as follows:
- .1 Acceptable Materials listings are based on the Consultant's determination that materials meet specified requirements and opinion of applicability to the project requirements.
- .2 Acceptable Materials listings are deemed to establish the standard of acceptance that the Consultant will consider appropriate for the Work.
- .3 Any product listed in the Acceptable Materials listing may be used to establish the Bid Price.

.2 Basis-of-Design Materials: The term Basis-of-Design Materials is used to specify a specific material name, manufacturer, catalogue number, model number or similar reference and is used as follows:
- .1 Basis-of-Design Materials are used to establish Consultant's preference for a single source product listing based on performance, appearance, or configuration.
- .2 Use the Basis-of-Design Material to establish the Bid Price unless an Addendum is issued adding additional Acceptable Materials.
- .3 Basis-of-Design Materials designation does not limit the Contractor's ability to submit Proposed Substitutions in accordance with Substitutions requirements of this Section and specific performance requirements listed in Technical Specification Sections.

.3 Non-proprietary specification means a specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does **not** include proprietary names of products or manufacturers.

.4 Substitution means a proposal from a Contractor to provide a product, material, or item of equipment not specified in the Contract documents but functionally equivalent and readily exchangeable to a specified item, for consideration by the Consultant and Owner.

1.3 SUBMITTALS

.1 When requested by Consultant, submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:
- .1 Product identification, including manufacturer's name and address.
- .2 Written verification that the substitute products can be obtained, meet the performance required for the project, and meet requirements of the Building Code.
- .3 Manufacturer's literature providing product description, applicable reference standards, and performance and test data.
- .4 Samples, as applicable.
- .5 Name and address of projects on which product has been used and date of each installation.
- .6 For substitutions and requests for changes to accepted products, include in addition to the above, the following:

.1 Itemized comparison of substitution with named product(s). List significant variations.
.2 Designation of availability of maintenance services and sources of replacement materials.

1.4 PRODUCT OPTIONS

.1 For products specified by non-proprietary specification:
.1 Select any product, assembly or material that meets or exceeds the specified standards for products specified only by referenced standards and performance criteria.

.2 Acceptable Materials: Select any named product, assembly or material contained in the listing of Acceptable Materials.

.3 Basis-of-Design Materials: Use the named product contained in the Basis-of-Design Material listing, unless an addendum is issued indicating acceptance of additional Acceptable Materials.

1.5 SUBSTITUTIONS

.1 The Contractor will assemble requests for substitutions requested by subcontractors and submit to the Consultant for review.

.2 The Consultant will review proposed substitute products for acceptability only when submitted by Contractor; Consultant will not review requests submitted independently by subcontractors.

.3 No substitutions will be permitted without Consultant's written acceptance; the Contractor will be required to remove products and replace with specified materials or provide a credit to the value of the contract at the Consultant’s discretion where substitutions are found in the Work that have not been formally accepted by the Consultant and Owner.

.4 The Consultant is not obliged to accept any Proposed Substitution offered by the Contractor and reserves the right to dismiss any item with no further explanation.

.5 Substitute Products: Where substitute products are permitted, unnamed products may be accepted by the Consultant, subject to the following:
.1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.

.6 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers may be accepted by the Consultant, subject to the following:
.1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturer(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.

.7 In making a proposal for substitution the Contractor represents:
.1 That they have personally investigated the proposal and (unless the proposal explicitly states otherwise) determined that it performs in a similar way or is superior to the product or method specified.
.2 That the same guaranty will be furnished as for the originally specified product or construction method.
.3 That they will coordinate installation of the accepted substitute into the Work, making such changes in the Work as may be required to accommodate the change.

.4 That they will bear costs and waives claims for additional compensation for costs and time that subsequently become apparent arising out of the substitution.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
    .1 CCDC 5B

.2 Owner's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Consultant.

1.3 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm, and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Consultant.

.4 Report to Consultant when reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

.1 Establish two permanent benchmarks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation column locations and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

1.5 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Consultant.

1.6 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures, and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access, and maintenance.

.3 Inform Consultant of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

1.7 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles, and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.8 SUBMITTALS

.1 Submit name and address of Surveyor to Consultant.

.2 On request of Consultant, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

1.9 SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should the Consultant determine that conditions differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:
- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 Include in request:
- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Remove samples of installed Work for testing.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.10 Restore work with new products in accordance with requirements of Contract Documents.

.11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
  .1 CCDC 5B

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only.

.4 Arrange for and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 FINAL CLEANING

.1 Clean work prior to final review by Consultant.

.2 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.3 Remove waste in accordance with Section 01 74 21 – Waste Management and Disposal.

.4 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.

.5 Prior to final review remove surplus products, tools, construction machinery and equipment.

.6 Remove waste products and debris including that caused by Owner or other Contractors.

.7 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

.8 Arrange for and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.9 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched, or disfigured glass.

.10 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.11 Clean lighting reflectors, lenses, and other lighting surfaces.

.12 Vacuum clean and dust building interiors, behind grilles, louvres, and screens.

.13 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.14 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.15 Broom clean and wash exterior walks, steps, and surfaces; rake clean other surfaces of grounds.

.16 Remove dirt and other disfiguration from exterior surfaces.

.17 Clean and sweep roofs, gutters, areaways, and sunken wells.

.18 Sweep and wash clean paved areas.

.19 Clean equipment and fixtures to sanitary condition.

.20 Clean mechanical equipment including replacement of filters.

.21 Clean roofs, downspouts, and drainage systems.

.22 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.23 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Consultant to review and discuss Waste Management Plan and Goals.

.2 Accomplish maximum control of solid construction waste.

.3 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Inert Fill: inert waste - exclusively asphalt and concrete.

.3 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.4 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.5 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.6 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

- .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
- .2 Returning reusable items including pallets or unused products to vendors.

.8 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.9 Separate Condition: refers to waste sorted into individual types.

.10 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

1.3 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled, and salvaged in locations as directed by Consultant.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store, and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Consultant.

.6 Protect surface drainage, mechanical and electrical from damage and blockage.

.7 Separate and store materials produced during dismantling of structures in designated areas.

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
- .1 On-site source separation is recommended.
- .2 Remove co-mingled materials to off-site processing facility for separation.

1.4 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, and paint thinner into waterways, storm, or sanitary sewers.

1.5 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

1.6 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

2 Products

2.1 NOT USED

3 Execution

3.1 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Consultant, and consistent with applicable fire regulations.
- .1 Mark containers or stockpile areas.
- .2 Provide instruction on disposal practices.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Starting equipment in preparation for adjusting and commissioning.

.2 To bring the facility to a fully operational state, free of deficiencies, in the most efficient and timely manner achievable.

.3 Contractor's and Owner's responsibilities during each of the following successive sub phases of facility start-up:

- .1 Contractor start-up which leads to Interim Acceptance of the Work.
- .2 Performance testing which leads to Practical Completion of the Work.

1.2 RELATED SECTIONS

.1 Section 01 75 19 - Testing, Adjusting and Balancing.

.2 Section 01 91 00 – Commissioning

1.3 STARTING SYSTEMS

.1 Coordinate schedule for start-up of various equipment and systems.

.2 Notify Consultant seven (7) calendar days prior to start-up of each item.

.3 Verify that each piece of equipment or system has been checked for proper may cause damage.

.4 Verify tests, metre readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

.5 Verify that wiring and support components for equipment are complete and tested.

.6 Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

.7 When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

.8 Submit in accordance with Section 01 33 00, a written start-up report confirming the results of the start-up of each piece of equipment or system. The written start up report will confirm that the equipment and or system has been properly installed and is functioning correctly. The start-up report will also be supported with copies of the actual verification and testing documentation used on site.

1.4 COMMISSIONING MANUAL

.1 Contractor to develop, complete and provide the report forms for all control points, software and hardware.

.2 Contractor will assemble completed report forms into a commissioning manual the following subjects:

- .1 Each mechanical system (except for controls).
- .2 Each electrical system

.3 Include manufacturer's equipment start-up reports and test certificates as an appendix to the commissioning manual.

.4 The commissioning manual will be kept on site for use by appropriate contractors.
- .1 Maintain this manual current.
- .2 Maintain a schedule for work of the commissioning agent in conjunction with the commissioning schedule.

.5 The report forms are divided into three parts:
- .1 Technical Data
- .2 Static Checks
- .3 Operational Checks

.6 Contractor is responsible for compiling the report forms and verifications of all parties as indicated below:
- .1 Technical Data
  - .1 Specified: Consultant
  - .2 Shop Drawing: Contractor
  - .3 Installed: Contractor
  - .4 Verified: Consultant
  - .5 Date/Checked By: Contractor to sign when all shop drawing and
  - .6 Installed information is completed.
- .2 Static Checks
  - .1 Confirmation of Completion: Contractor to confirm all items listed are Completed prior to verification by the Consultant.
  - .2 Date / Checked By: Contractor to sign when the installation of the equipment and or systems are complete and ready for the Consultant to verify.
- .3 Operational Checks
  - .1 Operational checks will be performed by the Operators and Consultant using the balancing report and control forms.

1.5 SUBMISSIONS

.1 Provide a sample of manufacturer's start-up forms for equipment or systems not included.

.2 Submit a completed and verified commissioning manual to the Consultant with all data entered and sign-offs, prior to Substantial Performance of the Work.

1.6 CONTRACTOR START-UP

.1 Contractor to perform the following during start-up:
- .1 Start equipment and systems.
- .2 Test, adjust and balance equipment and systems as specified in Section 01 75 19.
- .3 Demonstrate equipment and systems as required.

.2 Complete and submit start-up reports including:
- .1 Contractor's system and equipment start up reports.
- .2 Manufacturers' equipment start up reports.

.3 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with requirements of Contract Documents.

.4 Correct Contract deficiencies and defects identified as a result of the foregoing and as may be identified by the Consultant.

.5 Execute and complete approved Change Orders.

.6 Perform other work and activities required for fulfillment of prerequisites to Interim Acceptance of the Work.

.7 Consultant will perform the following during start-up:
- .1 Perform preliminary interim inspections as necessary.
- .2 Witness manufacturers' equipment start-up.
- .3 Verify starting, testing, adjusting, and balancing by Contractor.
- .4 Cooperate in systems and equipment demonstration and instruction.
- .5 Initiate Change Orders as required.
- .6 Verify correction of Contract deficiencies and defects by Contractor.
- .7 Verify execution of Change Orders performed by Contractor.
- .8 Perform other activities related to Substantial Performance of the Work.

.8 The following will be performed to an on-going cycle of:
- .1 Consultant's inspections.
- .2 Documentation of results.
- .3 Diagnosis of problems.
- .4 Correction of Contract Deficiencies and execution of Change Orders as required.

1.7 PERFORMANCE TESTING

.1 Refer to Section 01 91 00 – Commissioning

1.8 PARTIAL UTILIZATION OF WORK

.1 When partial utilization of the Work is required, the applicable requirements specified in this section apply to the part(s) of the Work to be utilized.

2 Products

2.1 NOT USED

3 Execution

3.1 APPLICATION

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Adjusting products and equipment required by all specification's sections for this Project.

1.2 PURPOSE

.1 Testing adjusting and balancing of operating systems.

.2 Prior to start of balancing, the Contractor is to ensure systems are:

- .1 Piped, ducted, wired and wireless services and systems, including components and equipment forming part thereof,
- .2 Manually and mechanically operated, including components and equipment forming any part,
- .3 Testing, adjusting, and balancing will not be started until after all static checks have been completed for the system being balanced and signed off on the commissioning report forms,
- .4 Contractor to ensure systems are operated at designated times, under conditions required for proper testing, adjusting, and balancing,
- .5 Report any deficiencies or defects which may affect the balancing or noted during testing, adjusting, and balancing, which cannot be promptly corrected.

2 Products

2.1 NOT USED

3 Execution

3.1 PREPARATION

.1 Prepare each system and item of equipment for testing, adjusting, and balancing.

.2 Verify that each system and equipment installation is complete and in functional operation.

.3 Verify appropriate ambient conditions.

3.2 TESTING

.1 Tests will be conducted to confirm compliance with requirements of Contract Documents. Take corrective action as necessary.

3.3 ADJUSTING

.1 Adjust operating Products and equipment to ensure smooth and unhindered operation.

.1 Provide equipment required to ensure proper, efficient, and safe operation of all Equipment including belts and sheaves.

3.4 BALANCING

.1 Ensure that the various parts of system are in a proper state of equilibrium.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
- .1 CCDC 5B

1.2 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
- .1 Notify Consultant in writing of satisfactory completion of Contractor's inspection and that corrections have been made.
- .2 Request Consultant's review.
- .3 Consultant's Review: Consultant and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.2 Completion: submit written certificate that following have been performed:
- .1 Work has been completed and inspected for compliance with Contract Documents.
- .2 Defects have been corrected and deficiencies have been completed.
- .3 Equipment and systems have been tested, adjusted, and balanced and are fully operational.
- .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, and Utility companies] have been submitted.
- .5 Operation of systems have been demonstrated to Owner's personnel.
- .6 Work is complete and ready for final inspection.

.3 Final Review: when items noted above are completed, request final inspection of Work by Owner, Consultant, and Contractor. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request re-inspection.

.4 Declaration of Substantial Performance: when Owner and Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance. Refer to CCDC 5B, General Conditions Article for specifics to application.

.5 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.6 Final Payment: when Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to CCDC 5B. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request re-inspection.

.7 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with CCDC 5B.

1.3 CLEANING

.1 In accordance with Section 01 74 11 – Cleaning.

.2 Remove waste and surplus materials, rubbish, and construction facilities from the site in accordance with Section 01 74 21 - Waste Management and Disposal.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Copy will be returned after final review, with Consultant's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, three final copies of operating and maintenance manuals in English along with pdf version on a CD in English.

.6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged, or defective, and of same quality and manufacture as products provided in Work.

.7 Furnish evidence, if requested, for 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.

.10 Submit `redline` marked up construction drawings to the Consultant within 30 days of Substantial Performance and prior to final completion.

1.2 FORMAT

.1 Organize data as instructional manual.

.2 Binders: hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.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, process flow, 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: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project:
- .1 Date of submission; names.
- .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: 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 Training: refer to Section 01 79 00 - Demonstration and Training.

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Consultant 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 record 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 RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Consultant.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of drawings, and in copy of Project Manual, provided by Consultant.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: 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: 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 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.7 REAL PROPERTY CERTIFICATE

.1 Supply to the Consultant, as soon as construction of foundations and basic ground floor levels are completed, a survey plan from a registered Alberta Land Surveyor.

.2 Plan shall show dimensioned building plan at ground level, distance from property lines, and elevation of the floor used as datum.

.3 This includes all buildings in Contract.

1.8 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. 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 coded 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.

.5 Maintenance Requirements: 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 co-ordination 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: include product data, with catalogue number, size, composition, and colour and texture designations. 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: 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, location as directed, place and store.

.4 Receive and catalogue items. Submit inventory listing to Consultant. 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, location as directed, place and store.

.4 Receive and catalogue items. Submit inventory listing to Consultant. 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, location as directed, place and store.

.4 Receive and catalogue items. Submit inventory listing to Consultant. 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 Consultant.

1.14 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Consultant approval.

.3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to Consultant for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Consultant.

.9 Include information contained in warranty management plan as follows:
- .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers, or suppliers involved.
- .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, and lightning protection systems.
- .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
  - .1 Name of item.
  - .2 Model and serial numbers.
  - .3 Location where installed.
  - .4 Name and phone numbers of manufacturers or suppliers.
  - .5 Names, addresses and telephone numbers of sources of spare parts.
  - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
  - .7 Cross-reference to warranty certificates as applicable.
  - .8 Starting point and duration of warranty period.
  - .9 Summary of maintenance procedures required to continue warranty in force.
  - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
  - .11 Organization, names and phone numbers of persons to call for warranty service.
  - .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.10 Respond in a timely manner to oral or written notification of required construction warranty repair work.

.11 Written verification will follow oral instructions. Failure to respond will be cause for the Consultant to proceed with action against Contractor.

1.15 PRE-WARRANTY CONFERENCE

.1 Meet with Consultant, to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Consultant.

.2 Consultant 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.

1.16 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Consultant.

.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.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.

.2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Consultant's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

.2 Testing, adjusting, and balancing has been performed in accordance with Requirements and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

.1 Ensure amount of time required for instruction of each item of equipment or system as follows:
- .1 Heating Plant: hours of instruction as required.
- .2 Cooling and Ventilation System: hours of instruction as required.
- .3 Control System: hours of instruction as required.
- .4 Plumbing System: hours of instruction as required.
- .5 Electrical Systems: hours of instruction as required.
- .6 Other systems as required.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Commissioning, testing and documentation.

1.2 DEFINITIONS

.1 Commissioning: The process for achieving, verifying, and documenting that the facility and its systems are planned, designed, installed, and tested to ensure that they meet the original project requirements established by the Owner and Consultant.

.2 Commissioning Team:
- .1 Owner's Representative: Representative of the Owner, as defined in the Agreement.
- .2 Consultant: Consultant, as defined in the Agreement.
- .3 Contractor Representatives: Representatives of the Contractor, including any subcontractors or suppliers whose scope of work includes items requiring commissioning. Contractor’s representative shall be the chair of the commissioning team and the Contractor shall lead, be responsible for, and organize all commissioning activities and documentation.

.3 Commissioning Documents:
- .1 Commissioning Plan: A project-specific document which defines the scope and approach to commissioning of this facility.
- .2 Submittal: Contract submittal, as specified in Contract Documents.
- .3 Static check certificate: A document used to verify equipment data installed, prior to start-up or operation.
- .4 Operating check certificate. A document used to verify equipment operation, including performance statistics.
- .5 Start-up Reports: Report prepared by equipment start-up personnel, including start-up sequence, and performance statistics.
- .6 Balancing Report: Report indicating initial and final system performance.
- .7 Maintenance Manual: A document containing detailed descriptions and technical information about start-up, operation and maintenance of equipment.

1.3 METHODOLOGY

.1 The Commissioning Team, led by the Contractor, shall develop a Commissioning Plan, including as a minimum the management of commissioning meetings, and the management of project-specific commissioning documents.

.2 Commissioning Plan to include:
- .1 Assembly of owner and consultant requirements, including design criteria, Performance goals.
- .2 Development of static and operating check certificates for individual equipment.
- .3 Assembly of commissioning information, including testing and balancing reports, Maintenance manuals, start-up reports, and testing reports.
- .4 Verification of data.
- .5 Audit procedure, to be performed in the event of dispute or failure.

.3 Execute the commissioning plan.

1.4 REGULATORY REQUIREMENTS

.1 Arrange for regulatory authorities to witness those commissioning start up procedures which are also required by regulatory authorities.

.2 Obtain certificates of approval and for compliance with regulations from Authorities having Jurisdiction; include copies of certificates with start-up reports.

1.5 CONTRACT COMMISSIONING REQUIREMENTS

.1 Witnessing: Allow commissioning team members to witness starting, testing, adjusting, and balancing procedures.

.2 Costs: Pay costs associated with starting, testing, adjusting, and relevant instruments and supplies required to perform those duties.

.3 Employ experienced personnel for equipment start-up and commissioning, who are able to interpret results of readings and tests, and report the system status in a clear and concise manner.

.4 Provide all equipment required to perform testing, balancing, and commissioning of systems. Calibrate instruments used in start-up as accurate; provide calibration certificates if requested.

.5 Verify that equipment is installed in accordance with Contract Documents, and reviewed shop drawings. Sign and date static check certificates.

.6 Do not start up equipment unless static check sheets have been completed and submitted.

.7 Complete in detail, and sign operating check certificates.

2 Products

2.1 NOT USED

3 Execution

3.1 COMMISSIONING TESTING

.1 Allow for work, effort, and associated costs.

.2 Coordinate, cooperate, and harmonize efforts with the Owner and Consultant.

.3 Commission testing will include a testing and evaluation process as determined by the Owner, Consultant, and the Commissioning Manager.

.4 System and device checks to be suitably logged, tabulated, signed, and incorporated into project Operating and Maintenance Manuals.

.5 The commissioning process will not:
- .1 Preclude the duties and responsibilities described in the Contract Documents nor the requirements and obligations of the Contract,
- .2 Circumvent any required warranties,
- .3 Relieve the Contractor from warranty requirements, responsibilities, or obligations.

.6 Prior to commission testing, perform the following and provide copies to the Consultant, of component and assembly Contract Document compliance:
- .1 Static test certificates.
- .2 Equipment operating certificates.
- .3 Copies of valve tag list.
- .4 Inspection certificates from authorities having jurisdiction.
- .5 Required copies of shop drawings.

.6 Manufacturer's operating and maintenance brochures of all major equipment.

.7 Ensure all systems have been started, adjusted to design criteria, and are functionally operational, ready for independent testing.

3.2 ACCEPTANCE TESTING

.1 After successful commissioning of the complete system, the complete functioning system shall undergo a 15-day acceptance test. During this period, all system functions shall be exercised, and any interruption shall be reviewed and investigated for the cause of failure. Verification of a failure shall cause termination of 15-day acceptance test, along with corresponding delay in substantial completion. When the cause of failure has been corrected, a new 15-day acceptance test shall be repeated, until a successful 15-day acceptance test without any failure. Substantial completion shall only be granted upon the successful completion of the 15-day acceptance test.

END OF SECTION

DIVISION 02

EXISTING CONDITIONS

1 General

1.1 INTENT

.1 To clarify and assign responsibilities for establishment of existing conditions at the Place of Work, with specific focus on both infrastructure and utilities (shallow and deep).

.2 The general and supplementary conditions of the contract, addenda, drawings and all other sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 RESPONSIBILITIES

.1 Consultant Responsibilities:
- .1 To support and facilitate the development of solutions for issues identified by the Contractor.

.2 Contractor Responsibilities:
- .1 To verify and confirm location of all existing infrastructure and utilities (deep and shallow) within the Place of Work.
- .2 To notify the Consultant of discrepancies with the provided information within the Contract Documents, and to Work with the Consultant in developing solutions to the issues identified.

2 Products

2.1 NOT USED

3 Execution

3.1 EXISTING CONDITIONS ASSESSMENT WORKFLOW

.1 Upon mobilization to site the Contractor shall undertake the following steps to verify the existing conditions within the Place of Work:
- .1 Photograph and document the condition of the Place of Work prior to commencing the Work.
- .2 Verify that the existing conditions (including infrastructure), match the information provided within the Contract Documents. Any deviations shall be communicated to the Consultant in writing in a timely manner.
- .3 Undertake an Alberta One Call of the entire Place of Work.
- .4 Prior to commencing construction of the Work, expose and verify all below ground infrastructure and utilities (deep and shallow) that interface with the Work. The Contractor shall photograph, survey and document any exposed items (including damage) and verify against the Contract Documents. Any deviations shall be communicated to the Consultant in writing in a timely manner.

.2 All deviations shall be communicated to the Consultant in accordance with Section 01 26 13 – Requests for Interpretation.

END OF SECTION

DIVISION 03

CONCRETE

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 Provision for Concrete Forming and Accessories

1.3 Reference Standards

.1 General

.1 The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

.2 Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

.3 Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

.2 Canadian Standards Association (CSA International)

.1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA O86-19, Engineering Design in Wood.

.3 CSA O121 17, Douglas Fir Plywood.

.4 CSA O151 17, Canadian Softwood Plywood.

.5 CSA O153 19, Poplar Plywood.

.6 CSA O325-16, Construction Sheathing.

.7 CSA O437 Series 93(R2011), Standards for OSB and Waferboard.

.8 CSA S269.1 16, Falsework and Formwork.

.3 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-17, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 Submittals

.1 Provide submittals in accordance with submittal procedures outlined in contract documents.

.2 Submit shop drawings for formwork and falsework.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.3 Co-ordinate submittal requirements and provide submittals required by Contract Documents.

.4 Indicate method and schedule of construction, shoring, stripping and re shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA S269.3 for formwork drawings.

.5 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.6 Indicate sequence of erection and removal of formwork/falsework as directed by Engineer.

1.5 Delivery, Storage and Handling

.1 Store and manage hazardous materials in accordance with Contract Documents and Standards.

Part 2 PRODUCTS

2.1 Materials

.1 Materials and resources in accordance with Contract Documents and Standards.

.2 Do verification requirements in accordance with Contract Documents and Standards.

.3 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA O86.

.2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.

.3 Rigid insulation board: to CAN/ULC-S701.

.4 Pan forms: removable and steel as indicated.

.5 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.6 Form liner:

.1 Plywood: Douglas Fir to CSA O121, 19 mm thick minimum.

.7 Form release agent: non toxic, biodegradable.

.8 Form stripping agent: colourless mineral oil, non toxic, biodegradable, 15 to 25 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.9 Falsework materials: to CSA S269.1.

.10 Sealant: to Section 07 92 00 Sealants.

Part 3 EXECUTION

3.1 Fabrication and Erection

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain Owner’s Representative's approval for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.6 Do not place shores and mud sills on frozen ground.

.7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.8 Fabricate and erect formwork in accordance with CAN/CSA S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.

.9 Align form joints and make watertight.

.1 Keep form joints to minimum.

.10 Locate horizontal form joints for exposed columns 2400mm above finished floor elevation.

.11 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.13 Construct forms for architectural concrete, and place ties as directed.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.14 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.15 Line forms for following surfaces:

.1 Outer face of beams.

.2 Soffit of girders and underside of bridge decks if exposed.

.3 Exposed faces of abutments, wingwalls, piers and pylons: do not stagger joints of form lining material and align joints to obtain uniform pattern.

.4 Secure lining taut to formwork to prevent folds.

.5 Pull down lining over edges of formwork panels.

.6 Ensure lining is new and not reused material.

.7 Ensure lining is dry and free of oil when concrete is poured.

.8 Application of form release agents on formwork surface is prohibited where drainage lining is used.

.9 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.

.10 Cost of textile lining is included in price of concrete for corresponding portion of Work.

.16 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

.17 When slip forming and flying forms are used, submit details as indicated in PART 1 - SUBMITTALS.

3.2 Removal and Re Shoring

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 4 days for walls and sides of beams.

.2 4 days for columns.

.3 4 days for beam soffits, slabs, decks and other structural members, or 2 days when replaced immediately with adequate shoring to standard specified for falsework.

.4 4 days for footings and abutments.

.2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000mm apart.

.5 Re use formwork and falsework subject to requirements of CSA A23.1/A23.2.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.4 Concrete reinforcing shall conform to the requirements of the reference Standards unless otherwise noted.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 The provision of steel reinforcing for concrete reinforcing as shown on drawings.

1.3 Reference Standards

.1 General

.1 The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

.2 Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

.3 Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

.2 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.3 ASTM International

.1 ASTM A143/A143M-07(2020), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A775/A775M-19, Standard Specification for Epoxy Coated Reinforcing Steel Bars.

.4 CSA International

.1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA A23.3-19, Design of Concrete Structures.

.3 CSA G30.18-09(R2019), Carbon Steel Bars for Concrete Reinforcement.

.4 CSA G40.20/G40.2-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.5 Reinforcing Steel Institute of Canada (RSIC)

.1 RISC-2020, Reinforcing Steel Manual of Standard Practice

1.4 Submittals

.1 Provide submittals in accordance with submittal procedures outlined in contract documents.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Submit shop drawings stamped and signed by professional engineer registered or licensed in Province of Alberta of Canada for concrete reinforcement, bar support and accessories for review by the Owner's Representative and Structural Engineer at least 14 days prior to the placement of rebar.

.4 Clearly indicate placing of reinforcement, including bar sizes, grades, spacing, bar bending details, location and quantities of reinforcing mesh and mechanical splices if approved by Owner's Representative, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Detail lap lengths and bar development lengths to CAN/CSA A23.3, unless otherwise indicated.

.6 Placing drawings and bar lists will be reviewed for number and size of bars only and this review shall in no way relieve the Contractor of his responsibility for carrying for carrying out the Work in accordance with the drawings.

.7 Substitution of imperial reinforcing sizes and grades will only be accepted if placing drawings showing imperial sizes are submitted to the Structural Engineer for review. Approval must be obtained before any work is commenced.

.8 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Owner's Representative prior to its use.

1.5 Quality Assurance

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.1 Mill Test Report: upon request, provide Owner's Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request submit in writing to Owner's Representative proposed source of reinforcement material to be supplied.

1.6 Certification for Epoxy Reinforcing Bars

.1 Provide to the Structural Engineer and Testing Agency a written certification, as per the Standard, that properly identifies the number of each batch of coating material used in the order, material, quantity represented, date of manufacture, name and address of the manufacturer, and a statement that the supplied coating material meets the requirements of the Standard.

.2 Provide to the Engineer and Testing Agency, at the time of shipment, written certification that the coated reinforcing bars meet the requirements of the Standard.

1.7 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with Contract Documents and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 Materials

.1 Substitute different size bars only if permitted in writing by Owner's Representative.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA G30.18, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.

.4 Cold drawn annealed steel wire ties to ASTM A82/A82M.

.5 Deformed steel wire for concrete reinforcement to ASTM A82/A82M.

.6 Welded steel wire fabric to ASTM A185/A185M.

.1 Provide in flat sheets only.

.7 Welded deformed steel wire fabric to ASTM A82/A82M.

.1 Provide in flat sheets only.

.8 Epoxy Coating of non-prestressed reinforcement to ASTM A775/A775M. The bar shall be coated with a primer or a conversion coating to improve adhesion of the epoxy to the bar.

.9 Plastic ties or plastic coated wires shall be used for tying epoxy-coated reinforcement

.10 Galvanizing of non-prestressed reinforcement to CAN/CSA-G164, ASTM A767M Class I, minimum zinc coating 610 g/m². 10M and smaller reinforcing bars shall have a minimum zinc coating of 915 grams per square meter. 15M and larger reinforcing bars shall have a minimum zinc coating of 1070 grams per square meter.

.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.

.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.

.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.

.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.

.1 In this case, no restriction applies to temperature of solution.

.4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.

.1 Provide product description as described in PART 1 - SUBMITTALS.

.11 Hot dip galvanized wire with a minimum core diameter of 1.44 mm (16.5 ga.) shall be used for tying galvanized reinforcement.

.12 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

.13 Mechanical splices: subject to approval of Owner's Representative.

.14 Plain round bars to CSA G40.20/G40.21.

2.2 Fabrication

.1 Fabricate reinforcing steel in accordance with reviewed shop drawings and Standards.

.2 Reinforcing bars shall be cold bent. Bars shall not be straightened or re-bent.

.3 Obtain Owner's Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.

.4 Upon approval of Owner's Representative, weld reinforcement in accordance with CSA W186.

.5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 Source Quality Control

.1 Upon request, provide Owner's Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request, inform Owner's Representative of proposed source of material to be supplied.

Part 3 EXECUTION

3.1 General

.1 All phases of concrete reinforcement work shall be in accordance with the Standards unless otherwise specified herein or on the drawings. The contractor shall ensure that only workers who are skilled and experienced in their trade do the work.

.2 The Contractor shall notify the Engineer at least 24 hours before any concrete is placed in order that the Engineer may review the work.

.3 No concrete shall be placed until the Structural Engineer has completed his/her review of reinforcing in place. The Contractor shall provide a minimum of 24 hours notice of the time when the reinforcement will be substantially in place and ready for the Structural Engineers review.

.4 For galvanized and epoxy coated reinforcing bars, all systems for handling shall have padded contact areas. All bundling bands shall be padded or suitable banding shall be used to prevent damage to the coating. All bundles of coated bars shall be lifted with a strong back, spreader bar, multiple supports, or a platform bridge to prevent bar-to bar abrasion from sags in the bundles of coated bars. The bars or bundles shall not be dropped or dragged.

3.2 Preparation

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment to be 1 hour per 25 mm of bar diameter.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.3 Product Delivery, Storage and Handling

.1 Store reinforcement in a manner to prevent excessive rusting and fouling with dirt, grease, form-oil and other bond-breaking coatings

.2 Reinforcement at the time concrete is placed shall be free from excessive rusting, mud, oil or other coatings that adversely affect its bonding capacity

3.4 Field Bending

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Owner's Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.5 Placing Reinforcement

.1 Place reinforcing steel as indicated on placing drawings and in accordance with Standard.

.2 The specified cover for steel reinforcement in reinforced concrete shall not be less than the largest of the limits for each relevant exposure condition in Table 17 of CSA A23.1.

.3 Use plain round bars as slip dowels in concrete.

.1 Paint portion of dowel intended to move within hardened concrete with [one coat of asphalt paint].

.2 When paint is dry, apply thick even film of mineral lubricating grease.

.4 Prior to placing concrete, obtain Owner's Representative's approval of reinforcing material and placement.

.5 Ensure cover to reinforcement is maintained during concrete pour.

.6 Reinforcement shall be secured against displacement within the tolerances permitted in the Standard with chairs, spacers, support bars, hangers or other accessories. Support devices contacting surfaces exposed to the exterior shall be noncorrosive.

.7 All rebar shall be adequately tied and chaired to maintain it in the specified location during pouring. Lifting of reinforcing or welded wire mesh into specified position during the concrete pour will not be allowed.

.8 Bars that are not part of the structural design or drawings, and whose only function is supporting other reinforcing in lieu of other support accessories, shall be considered as accessories.

.9 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

3.6 Field Touch-Up

.1 Repair coating damage with patching material approved by Structural Engineer and Testing Agency.

.2 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

.3 Repair of coating damage to not exceed 5% of surface area of the bar.

.4 Coated bars which do not meet the requirements of this specification shall be rejected. Coated bars having defects shall be replaced or alternately stripped of coating, re-cleaned and recoated in accordance with the requirements of this specification.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.3 Provide all labour, materials, equipment and services necessary to supply and install cast in place concrete work shown or indicated in all the contract drawings and specifications including concrete toppings, bases, sumps, curbs, posts, manholes, pits, paving, sidewalks, equipment bases or curbs, grouting of baseplates, etc.

.4 Coordinate concrete placement fully with other trades. Ensure other related work such as inserts, dowels, sleeves, reinforcement, etc. is complete before placing concrete.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 The provision for cast-in-place concrete as shown on drawings.

1.3 Reference Standards

.1 General

.1 The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

.2 Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

.3 Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

.2 ASTM International

.1 ASTM C260/260M-10a (2016), Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309 19, Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M 17, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412 16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension.

.6 ASTM D624 00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

.7 ASTM D1751 18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.8 ASTM D1752 18, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.3 CSA International

.1 CSA A23.1/A23.2 19, Concrete Materials and Methods of Concrete Construction/ Test Methods and Standard Practices for Concrete.

.2 CSA A283-19, Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-18, Cementitious Materials Compendium

1.4 1.5 Abbreviations and Acronyms

.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

.1 Type GU or GUb - General use cement.

.2 Type MS or MSb - Moderate sulphate-resistant cement.

.3 Type MH or MHb - Moderate heat of hydration cement.

.4 Type HE or Heb - High early-strength cement.

.5 Type LH or LHb - Low heat of hydration cement.

.6 Type HS or HSb - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with CaO content less than 8%.

.2 Type CI - with CaO content ranging from 8 to 20%.

.3 Type CH - with CaO greater than 20%.

.3 GGBFS - Ground, granulated blast-furnace slag.

1.5 Submittals

.1 Provide submittals in accordance with submittal procedures outlined in contract documents.

.2 Keep an accurate record at the job site showing date, time, and place of each pour of concrete, together with a transit-mix delivery slip certifying contents of pour. Make the record available to the Owner for his inspection upon request. Upon completion of this portion of work, submit placing records and delivery slips to the Owner.

.3 Submit details of proposed methods of concrete curing and provisions for weather protection to the Structural Engineer for review

.4 Submit plan locations and details of construction joints for the Structural Engineer's review.

.5 Provide testing, inspection results and reports for review by the Structural Engineer and do not proceed without written approval when deviations from mix design or parameters are found.

.6 Provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.7 Provide concrete hauling time deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

.8 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 Quality Assurance

.1 Provide Structural Engineer, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.2 Quality Control Plan: provide written report to Structural Engineer verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 Delivery, Storage and Handling

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from Structural Engineer and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Structural Engineer.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 PRODUCTS

2.1 General

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

.2 Provide samples of materials on request

2.2 Materials

.1 Cement to CSA A3001, Type GU unless noted otherwise.

.2 Supplementary cementing materials: with minimum 20% Type F fly ash replacement by mass of total cementitious materials to CSA A3001.

.3 Mixing Water to CSA A23.1.

.4 Air entraining admixture to CAN3 A266.1.

.5 Aggregates to CSA A23.1/A23.2.

.6 Chemical admixtures may be used for specific purposes providing they conform to the Standard and only as approved by the Structural Engineer.

.7 Calcium chloride, either as a raw material or as a constituent in other admixtures, shall not be used.

.8 Shrinkage compensating grout: premixed compound consisting of non metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 50 MPa at 28 days.

.2 Net shrinkage at 28 days: maximum 0.1 %.

.9 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 50 MPa at 28 days.

.10 Curing compound: to CSA A23.1/A23.2.

.11 Weep hole tubes: plastic.

.12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.

.13 Polyethylene film: 6 mil thickness to CAN/CGSB 51.34.

.14 Bonding adhesive to the approval of the Structural Engineer.

.15 Topping to the approval of the Structural Engineer.

2.3 Mix Design

.1 Mix design to be completed by an approved materials testing agency and submitted to the Structural Engineer for approval two weeks prior to concrete being placed.

.2 Concrete mixes shall be proportioned by the supplier to meet the requirements for cement type, compressive strength, class of exposure, maximum aggregate size, slump, air content, and admixtures specified herein.

.3 All concrete shall be normal weight unless noted otherwise. Mix designs shall be as detailed in CSA-A23.1 Table 13, Alternate 1. The property requirements are shown below:

Element	28 d Compressive Strength (MPa)	Exposure Class	Special Requirements
Dry Well / Wet Well Slab	35	A-1	56 d strength
Grade Beams	35	S-1	56 d strength
Lean Concrete	10	N	

Part 3 EXECUTION

3.1 General

.1 All phases of concrete work shall be in accordance with the Standard unless otherwise specified herein or on the drawings. Only workers who are skilled and experienced in their trade shall do the work.

.2 The Contractor shall notify the Structural Engineer at least 24 hours before any concrete is placed to allow the Structural Engineer to review the work.

.3 No concrete shall be placed until the Structural Engineer has completed his/her review of reinforcing in place. The Contractor shall provide a minimum of 24 hours notice of the time when the reinforcement will be substantially in place and ready for the Structural Engineers review.

3.2 Preparation

.1 Obtain Structural Engineer's written approval before placing concrete.

.1 Provide 24 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Structural Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken

.10 In locations where new concrete is dowelled to existing Work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.

.11 Do not place load upon new concrete until authorized by Structural Engineer.

3.3 Installation/Application

.1 Do cast in place concrete work to CSA A23.1/A23.2.

.2 Openings, sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Structural Engineer.

.2 Where approved by Structural Engineer, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Structural Engineer.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Structural Engineer before placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on drawings.

.6 Openings and sleeves shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings.

.7 Openings and sleeves not shown on the structural drawings must be approved by the Structural Engineer.

.8 Set special inserts for strength testing as indicated and as required by non destructive method of testing concrete.

.3 Construction and Control joints:

.1 Construction joints shall conform to the Standard except that for horizontal joints in walls it will be sufficient to place fresh concrete on a clean rough surface unless directed otherwise by the Structural Engineer or otherwise noted on the structural drawings.

.2 Joints in slabs on grade shall be located as indicated on the structural and/or architectural drawings. Unless noted otherwise on the drawings a joint in the slab on grade may be a pour joint, trowelled joint, zip strip, saw cut, or other pre-approved method. The depth of joints shall be a minimum of ¼ of the thickness of the slab. Saw cut joints are to be completed within 24 hr. of placing. Alternative joint details are to be submitted in writing to the Structural Engineer and Owner’s Representative.

.3 For vertical joints in walls below grade, see standard detail on structural drawings. For locations, see architectural and structural drawings.

.4 Horizontal construction joints in walls and columns shall occur at the top of slab and at the underside of slab/beam systems unless noted otherwise on the structural drawings.

.5 Construction joints not shown in the drawings or specifications shall be subject to the approval of the Structural Engineer. The Structural Engineer may require keys, or extra reinforcing to be provided at the Structural Engineer's discretion with associated costs borne by the Contractor.

.6 The existing concrete surface at construction joints shall be wetted thoroughly immediately prior to placement of concrete.

.7 All exposed concrete construction joints shall also be approved by the Owner’s Representative.

.8 Unless noted otherwise on the drawings, control joints in walls are to be located at a maximum spacing of 12m (40') on centre and detailed as indicated on the structural drawings.

.9 Supply and install premoulded waterstops in construction joints where indicated on the drawings. Weld joints to make watertight. Install waterstops in accordance with manufacturer's printed instructions and to Owner's Representative's approval

.4 Anchor bolts:

.1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.

.2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Structural Engineer.

.1 Formed holes: 100 mm minimum diameter.

.2 Drilled holes: 25 mm minimum diameter larger than bolts used.

.3 Protect anchor bolt holes from water accumulations, snow and ice build ups.

.4 Set bolts and fill holes with epoxy grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.5 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.6 Dovetail anchor slots: in accordance with Section 04 05 00 - Common Work Results for Masonry.

.1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.

.2 Install continuous vertical anchor slots at 800 mm on centre where concrete walls are masonry faced.

.7 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.8 Finishing and curing:

.1 Curing procedures shall be in accordance with the Standard. Alternate methods may be used providing they produce concrete that meets the contract document requirements.

.2 Cold and hot weather protection shall comply with the Standard or the requirements on the structural drawings, whichever are more rigorous.

.3 Finish concrete to CSA A23.1/A23.2.

.4 Use procedures as reviewed by Owner's Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.5 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.6 Finish concrete floor to CSA A23.1/A23.2. Class.

.7 Provide scratch finish where floor tile is to be applied. Provide depression[s] to accommodate floor file.

.8 Provide float finish unless otherwise indicated.

.9 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

.9 Toppings:

.1 Topping mixture to meet minimum requirements as follows: Monolithic, Bonded overlay 50 mm thick.

.2 Make allowance for monolithic and bonded overlay topping thickness when pouring base course.

.3 Apply cement/sand grout to base course to CSA A23.1/A23.2.

.4 Place bonded topping to CSA A23.1/A23.2 and topping manufacturer's recommendations.

.5 Ensure that joints in topping are of same material as those in base course. Also ensure that their locations precisely match those in base course. Provide dividers as indicated.

.10 PVC Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by Owner’s Representative.

.8 In place of a PVC waterstop system, an alternate crystalline and swelling waterstop system may be submitted to the Owner’s Representative for review and approval.

.11 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Owner’s Representative.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction, and expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs on grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.12 Dampproof membrane:

.1 Install dampproof membrane under concrete slabs on grade inside building.

.2 Lap dampproof membrane minimum 150 mm at joints and seal.

.3 Seal punctures in dampproof membrane before placing concrete.

.4 Use patching material at least 150 mm larger than puncture and seal.

3.4 Tolerances

.1 Concrete tolerance to Standard or the requirements on the structural or architectural contract documents, whichever are more rigorous.

3.5 Field Quality Control

.1 Site tests: conduct tests as follows in accordance with Contract Documents and submit report as described in PART 1 - SUBMITTALS.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Owner's Representative for review to CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified to CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Owner's Representative.

.4 Pay for costs of tests as specified in Section 01 29 83 Payment Procedures for Testing Laboratory Services.

.5 Testing laboratory will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.7 Inspection or testing by Owner's Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.6 Rejection of Defective Work

.1 In the event that concrete tests do not conform to the requirements of this specification, or when conditions are such to cause doubt about the safety of the structure, testing of the structure will be undertaken at the direction of the Structural Engineer. This may entail further concrete tests, coring or load testing as per the Standard, or any other test the Structural Engineer deems suitable. Such test shall be made at the expense of the Contractor and to the satisfaction of the Structural Engineer.

.2 Where, in the opinion of the Structural Engineer, material or workmanship fails to meet the requirements of the specification, such work may be rejected. Work rejected shall be replaced or repaired to the approval of the Structural Engineer and at no additional cost to the Owner.

END OF SECTION

Part 1 GENERAL

1.1 Work Included

.1 Formwork for grout.

.2 Prepare surfaces to receive grout.

.3 Grout bearings, anchor bolts or sleeves, handrail posts, light standard base plates, post-tensioning ducts and other like items called for on the drawings.

1.2 Submittals

.1 Submit the proposed mix design for all grout mix types to the Engineer for review two weeks prior to their initial use.

.2 Submit data sheets for all proposed pre-mixed grouts to the Engineer for review.

1.3 Inspection and Testing of Grout

.1 Test all grout by an independent testing firm certified in accordance with CSA-A283.

.2 Compressive strength tests shall be conducted in accordance with CSA A23.2 for all types of grout used for each day that grout is produced.

1.4 Job Conditions

.1 Maintain surface at an ambient air temperature of minimum 10^{o}C for a minimum period of 24 hours prior to, during and 72 hours after application.

.2 Provide and maintain temporary weatherproof enclosures during inclement weather and during preparation, grouting and curing activities.

1.5 Payment

.1 Payment for the work of this section shall be on a lump sum basis as tendered which shall be full compensation for all labor, materials, and equipment necessary to complete the work, including all subsidiary and incidental items thereto for which separate payment is not elsewhere provided.

1.6 Acceptability

.1 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient.

.2 Additional testing, inspection and evaluation may be required where evidence points to a potentially deficient structure.

.3 Pay all costs for additional testing, inspection and analysis required to demonstrate the adequacy of a structure that does not meet the requirements of the contract documents.

Part 2 PRODUCTS

2.1 Grout

.1 Non-shrink grout: Pre-mixed, non-ferrous, Master Builders 713, Sika-Grout 212, or approved equal.

.2 Epoxy grout: Sikadur-42

.3 Dry pack grout: Non-shrink compound consisting of non-metallic aggregate and water. Minimum strength 35 MPa at 28 days. Air-entrain grout 5 – 8%.

.4 In lieu of dry pack grout, Agilia Concrete having a compressed strength of f’c = 50 MPa at 28 day may be used.

.5 Silica fume grout: Sika Grout 212 HP or approved equal.

2.2 Formwork Materials

.1 Plywood: Douglas Fir plywood, GIS, undamaged sheets with true edges.

.2 Lumber: Sound, sizes as required.

.3 Nails, spikes and staples: All are to be galvanized.

Part 3 EXECUTION

3.1 Examination

.1 Before starting this work, examine work done by others which affects this work.

.2 Rectify all conditions that would prejudice proper completion of this work.

.3 Commencement of work implies acceptance of existing conditions.

3.2 Surface Preparation

.1 Remove all defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping or other similar means until a sound, clean concrete surface is achieved

.2 Lightly roughen surface to ensure proper bond with grout.

.3 Remove primers, paints or apply mastic paint to all ferrous metal surfaces in contact with grout.

.4 Follow manufacturer’s directions with respect to saturation of surfaces with water prior to grouting.

3.3 Formwork

.1 Construct formwork accurately, ensuring grout conforms to lines, levels and dimensions indicated on drawings. Extend grout horizontally a minimum of 12 mm from the edge of all base plates.

.2 Arrange and assemble formwork to permit easy dismantling and stripping, ensuring grout is not damaged during formwork removal.

.3 Provide sufficient clearance for proper placement between formwork and area being grouted.

.4 Cover form surfaces with an acceptable release coating to prevent bond with grout.

3.4 Production

.1 Proportion and mix grout in accordance with manufacturer’s instructions.

3.5 Inspection

.1 To permit inspection of formwork and placing of grout, notify Engineer prior to placing grout.

END OF SECTION

DIVISION 05

METALS

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 The provision for Structural Steel Framing as shown on drawings.

1.3 Reference Standards

.1 General

.1 The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

.2 Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

.3 Refer to Division 01 Section General Requirements for the list of applicable regulatory requirements.

.2 ASTM International Inc.

.1 ASTM A36/A36M 19, Standard Specification for Carbon Structural Steel.

.2 ASTM A193/A193M 19, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature or High-Pressure Service and Other Special Purpose Applications.

.3 ASTM A307 14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.4 ASTM F3125/F3125M-18, Standard Specification fo rHigh Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 105 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).

.1 Handbook of the Canadian Institute of Steel Construction.

.2 CISC/CPMA Standard 2 75, Quick Drying Primer for use on Structural Steel.

.4 Canadian Standards Association (CSA International)

.1 CSA G40.20/G40.21 13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA G164 18, Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16-19, Design of Steel Structures.

.4 CSAS136 16, North American Specifications for the Design of Cold Formed Steel Structural Members.

.5 CSA W47.1 19, Certification of Companies for Fusion Welding of Steel.

.6 CSA W48 18, Filler Metals and Allied Materials for Metal Arc Welding.

.7 CSA W55.3 08(R2018), Certification of Companies for Resistance Welding of Steel and Aluminum

.8 CSA W59 18, Welded Steel Construction.

.5 Master Painters Institute

.1 MPI INT 5.1 08, Structural Steel and Metal Fabrications.

.2 MPI EXT 5.1 08, Structural Steel and Metal Fabrications.

.6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Structural Engineers (NACE) International

.1 NACE No. 3/SSPC SP 6 06, Commercial Blast Cleaning.

1.4 Submittals

.1 Provide submittals in accordance with submittal procedures outlined in contract documents.

.2 Provide shop drawings showing designed assemblies, components and connections prepared under direction of the Specialty Structural Engineer. The drawings shall be stamped and signed by this Specialty Structural Engineer registered or licensed in Province of Alberta, Canada.

.3 Shop drawings shall show complete shop and erection details necessary for fabrication and erection of the component parts of the structure, including cuts, copes, connections, holes, threaded fasteners, splices and location, type, size and extent of all welds. Splices not shown on the shop drawings will be rejected. All welds, both shop and field, shall be indicated by AWS Welding Symbols as specified in the CSA W59 Appendix D and E.

.4 Provide a shop drawing clearly locating all anchor bolts, embedded plates, baseplates, etc.

.5 Provide setting drawings, templates and directions for the installation of anchor bolts, plates and other devices.

.6 Review of the shop drawings by the Structural Engineer is intended as an assistance to the Contractor and does not relieve the Contractor of his responsibility for the completeness or accuracy of his work and its conformance with the contract documents.

.7 Clearly identify on the shop drawing all revisions, changes, or modifications.

.8 Resubmit reviewed shop drawings where noted in ISL Structural Engineering and Land Services review stamp, or when the Contractor makes revisions for his own purposes.

.9 Allow at least two (2) weeks for shop drawing review by the Structural Engineer.

.10 Provide a schedule of fabrication to the Owner’s Representative, Structural Engineer and Testing Agency prior to the commencement of the fabrication.

.11 Fabrication that commences prior to shop drawing review by the Structural Engineer is at the risk of the Contractor.

.12 Should the sections shown on the drawings not be procurable, or should substitution for those sections be desired, sections of equivalent strength, may be substituted if approved by the Owner’s Representative. In such cases full particulars, thereof must be submitted prior to the closing of Bid.

.13 Material substitutions after the closing of Bid, if accepted, will be at the Contractor’s cost.

1.5 Quality Assurance

.1 The Contractor shall submit, written evidence of qualification of the steel fabricators and erectors for welding under Canadian Welding Bureau requirements prior to starting work.

.2 The Contractor shall submit written evidence of ability to weld reinforcing steel to structural steel in accordance with CSA W186 prior to starting work.

.3 The Specialty Structural Engineer responsible for shop drawings, or their representative, shall visit the site to review in place the connections and components designed by that Specialty Structural Engineer. The Specialty Structural Engineer shall be satisfied or take steps to ensure that these connections and components substantially comply with the Specialty Structural Engineer's design. The Specialty Structural Engineer shall then provide a sealed and signed letter to the Owner's Representative and Structural Engineer to this effect.

.4 When requested, submit copies of mill test reports properly correlated to the materials used on the project.

1.6 Delivery, Storage and Handling

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

.2 The Contractor shall be responsible for the protection of all steelwork during fabrication, shipping, storage and construction. All damage shall be reported to the Structural Engineer for review. Steel work which is bent, broken or otherwise damaged, shall be repaired or replaced by the Contractor prior to erection to the satisfaction of the Structural Engineer at no cost to the Owner.

.3 The Contractor shall be responsible for proper scheduling of delivery and erection for the structural steel in accordance with the construction schedule.

.4 Store structural steel members at the site above ground on platforms, skids or other devices so that ground dampness will not affect the bottom members of the stacks.

.5 Steel shall be protected from accumulations of standing water.

.6 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

Part 2 PRODUCTS

2.1 Design Requirements

.1 Design details and connections in accordance with requirements of CAN/CSA S16 with CSA S136.1 to resist forces, moments, shears and allow for movements indicated.

.2 Unless otherwise noted connections and trusses shall be designed by the Contractor to the reference Standards by the Specialty Structural Engineer.

.3 Use standard connection types where connections are not detailed on the structural drawings.

.4 Where connections are detailed, use connection of the type and detail shown on the drawings. Modifications to the specified connection types and details will not be permitted without prior approval from the Structural Engineer.

.5 The following connections, and any connections so noted on the structural drawings, shall be designed as slip critical and shall be pre-tensioned:

.1 Trusses.

.2 Elements resisting crane loads.

.3 Connections for supports of running machines or other live loads that produce impact or cyclic loads.

.4 Connections where bolts are subject to repeated tensile loads.

.5 Connections using slotted holes in the direction of the load or oversize holes unless specifically designed to accommodate movement.

.6 Connections for wind or seismic lateral load-resisting elements, such as bracing and drag struts, and others so noted on the structural drawings may be designed as bearing connections but shall be pre-tensioned.

.7 Other bolted connections may be snug tight.

.8 Design shall be for the forces and loads shown on the drawings and shall allow for the effects of beam deflections. Provide a minimum of two (2) 19 mm (3/4") A325 bolts or an equivalent weld for all beam to girder and beam to column connections. If forces or loads are not given, the connection shall be designed for the maximum uniform distributed load that the member can carry for the span shown.

.9 Structural steel members spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing as directed by the Structural Engineer. The Contractor shall bear the cost for such testing.

.10 Provide stiffeners in beam webs at all locations where beams pass over supports. Unless noted otherwise in the structural drawings, web stiffeners shall be 10 mm minimum.

.11 Provide separators for all double members in accordance with CSA S16.

.12 For composite construction select or design minimum end connection to resist reaction resulting from factored movement resistance as tabulated in the "Handbook of the Canadian Institute of Steel Construction" assuming 100% shear connection with depth of steel deck and/or slab shown on drawings.

.13 Submit sketches and design calculations stamped and signed by qualified Specialty Structural Engineer licensed in Province of Alberta, Canada for non-standard connections.

2.2 Materials

.1 Structural steel to CSA G40.20/G40.21 Grade 300W.

.2 Anchor bolts to CSA G40.20/G40.21, Grade 300W ASTM A36/A36M.

.3 Bolts, nuts and washers to ASTM A325M.

.4 Welding materials to CSA W59 and certified by Canadian Welding Bureau.

.5 Electrode strengths to be equal to E480XX (E70XX) or better.

.6 Shop paint primer to ISC/CPMA2-75 solvent reducible alkyd

.7 Primer for interior exposure not to receive a shop or field paint finish to CISC / CPMA Standard 1-73a or other pre-approved, unless noted otherwise.

.8 Primer for exterior exposure not to receive a shop or field paint finish to CGSB 1-GP-40d or other pre-approved, unless noted otherwise.

.9 Primer used in a multi-coat system where a final shop or field paint finish is to be applied shall conform to Section 09900 - Painting and shall be selected and preapproved by the Architect based on surface preparation, exposure conditions and compatibility with subsequent coatings, unless noted otherwise.

.10 Framing materials exposed to weather, shall be galvanized to CSA G164.

.11 Hot dip galvanizing galvanize steel, where indicated, to CSA G164, minimum zinc coating of 600 g/m^2.

.12 Shear studs to CSA W59, Appendix H.

.13 Grout for column bases to be non-metallic, non-expanding and non-shrink type with a minimum strength of 35 MPa at 28 days, unless noted otherwise. Grout may be place in a dry pack or flowable consistency.

2.3 Fabrication

.1 Fabricate structural steel in accordance with CSA S16 and in accordance with reviewed shop drawings.

.2 Install shear studs in strict accordance with the manufacturer's instructions in accordance with CSA W59 and the Standards.

.3 Continuously seal members by continuous welds. Grind smooth.

.4 Unless noted otherwise, all hollow structural sections (HSS) shall be dry inside and closed airtight with end plates sealed with welds.

.5 Obtain Structural Engineer's approval for holes required through structural steel that are not shown on the drawings.

.6 Refer to Architectural drawings for extent and location of Architecturally exposed steel elements.

.7 Remove and replace any work which is not acceptable to the Owner's Representative, when and as directed. Such operation shall not become an extra charge to the Owner.

2.4 Shop Painting

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CSA S16.

.2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC SP 6.

.3 Apply one coat of primer in shop to steel surfaces, except:

.1 Surfaces to be encased in concrete.

.2 Surfaces on the underside of bearing or baseplates

.3 Surfaces to receive field installed stud shear connections.

.4 Surfaces and edges to be field welded.

.5 Faying surfaces of slip-critical connections.

.6 Coated or galvanized steel surfaces

.7 Below grade surfaces in contact with soil.

.4 Architecturally exposed steel members, related framing and exterior steel shall be primed.

.5 Other steel for interior exposure shall not be primed.

.6 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.7 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.8 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 EXECUTION

3.1 Application

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 General

.1 Structural steel work: in accordance with CSA S136.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.3 Connection to Existing Work

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Owner's Representative for direction before commencing fabrication.

3.4 Marking

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.5 Erection

.1 Erect structural steel, as indicated and in accordance with CSA S16 and in accordance with approved erection drawings.

.2 The erector is fully responsible for erection methods, equipment, workmanship and safety precautions.

.3 Confirm the setting of anchor bolts and bearing plates and make an instrument survey to verify the setting prior to erection of steel members.

.4 Cutting or burning of baseplates to accommodate anchor bolts shall be cause for rejection of baseplates.

.5 Install all temporary bracing that is required to stabilize the work against wind, earthquake and construction loads. Keep structure true and plumb until completion of the building.

.6 Assume complete responsibility for the extent and timing of the removal of temporary bracing.

.7 Any failure to make proper and adequate provisions for loads during erection shall be solely the responsibility of the Contractor.

.8 The Contractor shall be responsible for the design of all hooks, erection connections and handling gear.

.9 Provide all temporary flooring, planking and scaffolding necessary in connection with erection of structural steel, or support of erection machinery in accordance with governing regulations and by-laws.

.10 All construction loads shall be adequately distributed so as not to exceed the capacity of any member.

.11 Structural steel work on concrete shall be carefully located at the proper grade and rigidly secured in place, using steel shims. Spaces under the steel shall then be filled with non-shrink premix grout as soon as possible, and before placing any concrete toppings or precast concrete units.

.12 Plumb, level and align individual members of steel work as specified in CSA S16.

.13 The various members forming parts of complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.

.14 Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.

.15 Temporary bolts, clips and angles etc. used to facilitate erection shall be removed unless noted otherwise on the drawings.

.16 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.17 Continuously seal members by continuous welds where indicated. Grind smooth.

3.6 Field Painting

.1 Paint in accordance with Section 09 90 00 Painting.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC SP 6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

.2 Provide touch-up for galvanized steel. After erection and after connections are completed, provide a field touch-up coat of zinc rich paint to all surfaces that have been chipped or scraped.

END OF SECTION

DIVISION 06

WOOD, PLASTICS AND COMPOSITES

Part 1 GENERAL

1.1 General Requirements

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

.1 Section includes, but is not limited to the following, as shown on drawings.

- .1 Structural floor, wall, and roof framing
- .2 Built up structural beams and columns
- .3 Diaphragm trusses fabricated on site
- .4 Floor, wall, and roof sheathing
- .5 Sill gaskets
- .6 Preservative treatment of wood
- .7 Miscellaneous framing and sheathing
- .8 Telephone and electrical panel back boards
- .9 Concealed wood blocking for support of toilet and bath accessories, wall cabinets and siding

1.3 Reference Standards

.1 General

- .1 The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
- .2 Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
- .3 Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

.2 Canadian Standards Association (CSA International)

- .1 CSA O80 Series 15 Wood Preservation.
- .2 CSA O121 17 Douglas Fir Plywood
- .3 CSA O151 17 Canadian Softwood Plywood.
- .4 CSA O153 19 Poplar Plywood.
- .5 CSA O325 16 Construction Sheathing

.3 ANSI/NPA A208.1 1999 Particleboard.

.4 APA (American Plywood Association) Grades and Specifications.

.5 CAN/CGSB 11.3 M87 Hardboard.

.6 CANPLY (Canadian Plywood Association) Grading and certification.

.7 NLGA (National Lumber Grades Authority) Standard Grading Rules for Canadian Lumber, 2017 Edition.

1.4 Submittals

.1 Provide submittals in accordance with submittal procedures outlined in contract documents.

.2 Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

.3 Shop Drawings For Site Fabricated Truss Frame: Indicate dimensions, wood species and grades, component profiles, drilled holes, fasteners, connectors, erection details and sequence.

.4 Samples of Exposed to View Wood Members: Submit two (2) samples, illustrating wood grain, stain, and finish.

.5 Manufacturer's Certificate: Certify that Products conform to specified requirements.

1.5 Quality Assurance

.1 Products of This Section: Manufactured to ISO 14000 certification requirements.

.2 Perform Work in accordance with the following agencies:

.1 Lumber Grading Agency: Certified by NLGA.

.2 Plywood Grading Agency: Certified by CANPLY.

.3 In lieu of grade stamping exposed to view lumber and plywood, submit manufacturer's certificate certifying that products meet or exceed specified requirements.

.4 Design structural shop fabricated trusses under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.6 Delivery, Storage and Protection

.1 Protect materials from warping or other distortion by stacking in vertical position.

Part 2 PRODUCTS

2.1 Materials

.1 Dimensional Lumber: NLGA. SPF species, No 2 or better, 15 percent maximum moisture content at time of installation.

.2 Engineered Wood Products: Structural composites manufactured from veneer or strands of wood material (SCL,I-Joist, LVL, PSL, LSL etc),13.8 MPa (2.0E) minimum modulus of elasticity. TJI, LPI, Microllam, Parallam, TimberStrand, Versa Lam or other pre-approved products.

2.2 Panel Products

.1 Plywood Roof Sheathing: CSA O12 Grade SHG Veneer Grade C unsanded.

.2 Plywood Wall Sheathing: CSA O121 Grade SGH, Veneer Grade C,unsanded.

.3 Plywood Floor Sheathing: CSA O121 Grade SHG,Venner Grade C,unsanded.

.4 Telephone and Electrical Panel Boards: Plywood.

2.3 Underlayment Materials

2.4 Sheathing and Underlayment Locations

.1 Sloped Roof Sheathing: 12.5 mm thick min, square edges unless noted otherwise on plan.

.2 Flat Roof Sheathing: 15.5 mm thick min, tongue and groove edges.

.3 Above Grade Wall Sheathing: 12.5 mm thick min, square edges unless noted otherwise on plan.

.4 Floor Sheathing: 19 mm thick, tongue and groove edges.

2.5 Accessories

.1 Fasteners and Anchors:

.1 Fasteners: Hot dipped galvanized steel.

.2 Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

.2 Structural Framing Connectors: Joist and Beam Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

.3 Sill Gasket on Top of Foundation Wall: 6 mm thick, plate width wide, closed cell foam from continuous rolls.

.4 Sill Flashing (Under Sill Gasket): 6 mm thick, polyethylene sheet.

.5 Subfloor Glue: APA AFG 01, waterproof of water base, air cure type, cartridge dispensed.

.6 Building Paper: No.15 asphalt felt.

Part 3 EXECUTION

3.1 Framing

.1 Set structural members level and plumb, in correct position.

.2 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

.3 Place horizontal members crown-side up.

.4 Construct load bearing framing members full length without splices.

.5 Double members at openings over 400 mm wide. Space short studs over and under opening to stud spacing.

.6 Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists. Frame rigidly into joists.

.7 Bridge framing in excess of 2.3 m span as detailed. at mid span. Fit solid blocking at ends of members.

.8 Place sill gasket directly on cementitious foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

.9 Coordinate installation of wood decking, glue laminated structural units, prefabricated wood trusses, and plywood web joists.

.10 Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

.11 Coordinate curb installation with installation of decking and support of deck openings, roofing vapour retardant, parapet construction.

3.2 Sheathing

.1 Secure roof sheathing with longer edge perpendicular to framing members and with ends staggered and sheet ends over bearing.

.2 Use sheathing clips between sheets between roof framing members. Fully engage tongue and groove edges.

.3 Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.

.4 Place plywood or structural use panel sheeting at building corners for a horizontal distance of 1200 mm.

.5 Place building paper horizontally over wall sheathing; weather lap edges and ends.

.6 Secure subfloor sheathing with longer edge perpendicular to floor framing and with end joints staggered and sheet ends over bearing. Attach with subfloor glue and drywall screws.

.7 Install plywood to two span continuous.

.8 Place building paper between floor underlayment and subflooring.

.9 Install flooring underlayment after dust and dirt generating activities have ceased and prior to application of finished flooring. Apply perpendicular to subflooring, stagger joints of underlayment.

.10 Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board by 300 mm beyond size of electrical panel.

3.3 Erection Tolerances

.1 Framing Members: 6 mm from true position, maximum.

.2 Surface Flatness of Floor: 2 mm/m maximum, and 12 mm in 9 m maximum.

END OF SECTION

Part 1 GENERAL

1.1 Section Includes

.1 Roof curbs, cants, and perimeter nailers.

.2 Blocking in wall and roof openings.

.3 Wood furring and grounds.

.4 Telephone and electrical panel back boards.

.5 Concealed wood blocking for support of toilet and bath accessories, wall cabinets, wood trim.

.6 Preservative treatment of wood.

1.2 References

.1 ANSI/NPA A208.1-1999 - Particleboard.

.2 APA (American Plywood Association) - Grades and Specifications.

.3 CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.

.4 CSA-B111-1974(R2003) - Wire Nails, Spikes and Staples.

.5 CSA-O121-08 - Douglas Fir Plywood

.6 CSA-O141-05 - Softwood Lumber.

.7 CSA-O151-04 - Canadian Softwood Plywood.

.8 CSA-O153-M1980 (R2003) - Poplar Plywood.

.9 CSA-O80 Series-08 - Wood Preservation.

.10 CSA-O437 Series-93 (R2006) - OSB and Waferboard.

.11 National Lumber Grades Authority (NLGA) - Standard Grading Rules for Canadian Lumber, 2007 Edition.

1.3 Submittals for Review

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide technical data on wood preservative materials.

1.4 Submittals for Information

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Provide application instructions.

1.5 Quality Assurance

.1 Products of This Section: Manufactured to ISO 14000 certification requirements.

.2 Lumber Products: Graded and stamped to NLGA requirements.

.3 Plywood Products: Certified and graded to APA requirements.

Part 2 PRODUCTS

2.1 Materials

.1 Lumber: NLGA (Standard Grading Rules for Canadian Lumber). CSA-O141, softwood SPF species, grade No 2.

.1 19 percent maximum moisture content.

.2 Plywood: CSA-O151, Grade Select; unsanded.

.3 Particleboard: ANSI A208.1; unsanded faces.

.4 Mat-Formed Panelboards: CSA-O437, OSB, grade A.

2.2 Accessories

.1 Fasteners and Anchors: Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

.2 Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

Part 3 EXECUTION

3.1 Framing

.1 Set members level and plumb, in correct position.

.2 Place horizontal members, crown side up.

.3 Construct curb members of single pieces.

.4 Space framing 400 mm on centre.

.5 Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

.6 Coordinate curb installation with installation of decking and support of deck openings, roofing vapour retardant, parapet construction.

3.2 Sheathing

.1 Secure sheathing to framing members with ends over firm bearing and staggered.

.2 Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board by 300 mm beyond size of electrical panel.

3.3 Site Applied Wood Treatment

.1 Apply preservative treatment in accordance with manufacturer's written instructions.

.2 Brush apply two coats of preservative treatment on wood in contact with cementitious materials and Treat site-sawn cuts.

.3 Allow preservative to dry prior to erecting members.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

.1 All work related to the engineering and manufacturing of plate connected wood trusses.

1.3 Reference Standards

.1 General

.1 The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

.2 Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

.3 Refer to General Requirements for the list of applicable regulatory requirements.

.2 Canadian Standards Association (CSA International)

.1 CSA 086-19 Engineering Design in Wood

.2 Truss Plate Institute of Canada-latest edition.

1.4 Qualifications of Contractor

.1 Plate connected wood truss fabricator shall have not less than five (5) years' experience in the fabrication of wood trusses.

.2 Erection of plate connected wood trusses shall be performed by experienced journeyman carpenters, familiar with this type of framing.

1.5 Examination

.1 Prior to fabrication, the Contractor shall check all dimensions governing the work and shall report any discrepancies noted to the Owner's Representative.

.2 The Contractor shall report all failures of the materials to fit properly together to the Owner's Representative. Corrective work shall be to the Owner's Representative's approval.

1.6 Submittals

.1 Drawings which accompany these specifications are to be used for estimating purposes only and show in general, the type of construction which shall be followed, but must not be considered as fabrication drawings.

.2 Submit detailed shop drawings in accordance with the General Requirements. Shop drawings shall be stamped by a Professional Engineer licensed to practice in Alberta.

.3 Shop drawings shall clearly show materials, sizes, types, capacities, markings, spacing and quantities of wood trusses.

.4 Indicate methods of connecting, anchoring, fastening, bridging and attaching the work of other trades where required.

1.7 Field and Shop Services

.1 Field services by the Owner's Representative or his representative consist of periodic visits to the site or plant to familiarize himself with the general progress and quality of work.

.2 Field services by the Owner's Representative or his representative do not in any way relieve the Contractor of his responsibility to perform the work as indicated in the Contract Documents.

1.8 Product Handling

.1 Trusses shall be handled at the job site in such a manner as to prevent bending or damage of the trusses.

.2 Trusses shall be stored at the site above ground on platforms, skids or other supports so that ground dampness will not affect the bottom trusses of the stacks. Stacks of trusses shall not be of such height as to cause bending in members near the bottom.

Part 2 PRODUCTS

2.1 Design Requirements

.1 Design plate connected wood trusses and connections including roof overhangs for the loads shown on the drawings.

.2 Design all sub-assemblies or stick framing not specifically identified on drawings but necessary to support roof sheathing to loads shown on drawings.

.3 Where noted on drawings, provide all miscellaneous sawn lumber framing based on maximum span to depth ratio of 20. Depth of member to be determined from net finished depth.

.4 Design permanent bracing as required to maintain required capacity of trusses.

2.2 Materials

.1 Lumber: Seasoned to 15% average moisture content, grade stamped

.2 Plate connected trusses: S-P-F No. 1/2 or better as required to meet design demands.

.3 Miscellaneous framing: S-P-F No. 1/2 or better.

.4 Metal connector plates to ASTM A446-Grade A.

.5 Zinc coating for connector plates: Hot-dip galvanized designation Z275.

.6 Lag screws to ASTM A307.

2.3 Fabrication

.1 Fabricate trusses to CSA 086:19 and T.P.I.C. latest edition.

Part 3 EXECUTION

3.1 Examination

.1 Prior to site erection, examine all site conditions relating to this section or work to ensure they are acceptable for a satisfactory installation. Report any discrepancies to the Owner's Representative.

3.2 Connection to Existing Work

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Owner's Representative for direction before commencing fabrication.

3.3 Erection

.1 Handle and erect trusses to accommodate all erection stresses.

.2 Protect the trusses from damage using pads between slings and wood members and/or connection hardware.

.3 Erect trusses plumb and true with all necessary precautions against damage of any kind to the material and to the structure.

.4 Report every failure of members to come together properly. Any measures proposed for correction shall be submitted to the Owner's Representative for review.

.5 Provide and install temporary bracing as required to keep the structure plumb and true alignment during construction. Assume complete responsibility for the extent and timing of the removal of such bracing. The bracing members indicated on the drawings are required for the finished structure and shall not be considered adequate for temporary bracing. Any failure to make proper and adequate provision for stresses occurring during the erection from any causes whatsoever shall be entirely the responsibility of the Contractor.

.6 Damaged truss members or connection hardware shall be repaired to the Owner's Representative's satisfaction or replaced. Repair methods and procedures are to be submitted for review prior to performing any remedial work.

3.4 Completion

.1 The Registered Professional Engineer responsible for the sealed shop drawings, or his representative shall visit the site to review in place connections any components designed by that Registered Professional Engineer as required to substantiate compliance with his sealed shop drawings. He shall submit a letter of compliance to the Owner's Representative and Engineer to this effect.

.2 On completion of the Work of this section, all protection erected in conjunction with the wood truss work shall be removed, all damage to this work and adjoining work shall be made good and all surplus materials and debris and all tools, plant and equipment shall be removed from the site.

3.5 Field Quality Control

.1 Carry out work with adequate plant, equipment, and competent trades people in accordance with good practice and in accordance with drawings and specifications.

.2 Construction review by the Owner's Representative does not relieve the contractor of his responsibility to furnish materials and workmanship in accordance with the drawings and specifications.

END OF SECTION

Part 1 GENERAL

1.1 References

.1 The publications listed below (latest revision applicable) form a part of this specification to the extent referenced herein. The publications are referred to within the text by the designation only.

- .1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) Test Methods:
  - .1 ASTM D-638-Tensile Properties of Plastics
  - .2 ASTM D-790-Flexural Properties of Unreinforced and Reinforced Plastics
  - .3 ASTM D-2344-Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short Beam Method
  - .4 ASTM D-696-Coefficient of Linear Thermal Expansion for Plastics
  - .5 ASTM D-495-High Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation ASTM E-84-Surface Burning Characteristics of Building Materials
- .2 National Building Code – 2019 Alberta Edition
- .3 The Occupational Health and Safety Administration
- .4 Federal Register, Volume 39, No. 125, Section 1910.23
- .5 Federal Register, Volume 39, No. 125, Section 1910.27
- .6 NSF/ANSI STANDARD 61

1.2 Contractor Submittals

.1 The CONTRACTOR shall furnish shop drawings of all fabricated items and accessories in accordance with the provisions of this Section.

.2 The CONTRACTOR shall furnish manufacturer's approval drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details. Approval drawings shall be signed and sealed by a Professional Engineer registered in the Province of Alberta with at least five (5) years' experience in the design of structural FRP systems.

.3 The CONTRACTOR shall submit the manufacturer's published literature including structural design data, structural properties data, corrosion resistance tables, certificates of compliance, test reports as applicable, and design calculations for systems not sized or designed in the contract documents, sealed by a Professional Engineer.

.4 The CONTRACTOR may be requested to submit sample pieces of each item specified herein for acceptance by the ENGINEER as to quality and color. Sample pieces shall be manufactured by the method to be used in the WORK.

1.3 Quality Assurance

.1 All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

.2 The MANUFACTURER shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship.

.3 The MANUFACTURER shall be certified to the ISO 9001-2000 standard.

.4 Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (DNV, ABS, USCG, AARR).

.5 The MANUFACTURER may be requested to provide access to its fabrication facility as required by the Owner and shall be at Owner's expense. The MANUFACTURER shall give ample notice to OWNER prior to the beginning of any fabrication work so that inspection may be provided.

.6 The MANUFACTURER shall not sub-contract any portion of its work without consent of the OWNER.

.7 The MANUFACTURER shall make available a certified representative capable of attending pre-bid meetings, verifying site dimensions prior to fabrication and being available for site visits during installation as required.

1.4 Product Delivery and Storage

.1 Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

.2 Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, and other types of damage. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

Part 2 MATERIALS

2.1 Manufacturer

.1 Not used.

2.2 Pultruded Materials

.1 General

.1 All structural shapes are to be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

.2 Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

.3 Resins shall be DYNAFORM® ISOFR, fire retardant isophthalic polyester or VEFR, fire retardant vinyl ester with chemical formulations necessary to provide the required corrosion resistance, strength and other physical properties.

.4 All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

.5 E. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to produce a resin rich surface.

.6 All FRP products shall have a tested flame spread rating of 25 or less per ASTM E- 84 Tunnel Test.

.7 For potable water applications, all pultruded materials shall compliant with NSF/ANSI Standard 61.

.2 Handrail

.1 Handrail system to be designed in compliance with ABC 2006 and OSHA 1910-23 for industrial occupancies only.

.2 Top and bottom rails are to be 1.75" x 0.125" (44.4 mm x 3.2 mm) wall square tube, the posts are to be 2.125" x 0.1875" (53.9 mm x 4.8 mm) wall square tube and kickplate is to be 6" (152.4 mm) high with two reinforcing ribs.

.3 The completed handrail installation shall meet the following load requirements with a minimum factor of safety of 2.0:

Concentrated Load: 225 lb (1kN) applied in any direction at the top rail.

Uniform Load: 50 lb/lf (0.75 kN/m) of the top rail in any direction. Loads are assumed not to act concurrently.

.4 All rails, posts, and kick plates are to be integrally pigmented yellow.

.5 All fasteners used in the railing system are to be 316 SS. Rivets to be 18-8 SS.

.6 To avoid embrittlement at cold temperatures and loss of strength at high temperatures, no PVC or CPVC connectors should be used as a load carrying component of the handrail system.

.7 For potable water applications, all materials shall compliant with NSF/ANSI Standard 61. H.

.3 Ladders

.1 Fiberglass ladder system to be designed in compliance with OSHA 1910.27. The ladder shall also be capable of supporting a concentrated vertical load of 1,200 pounds (545 kg) applied at the mid-span of the rung. Manufacturer shall be required to provide supporting test data for rung capacity.

.2 All ladder side rails, rungs, ladder mounting brackets and cage straps are to be FRP structural shapes manufactured by the pultrusion process. Cage hoops and brackets shall be produced by the open molded hand lay-up method.

.3 Resin used to make ladder shapes shall be DYNAFORM® VEFR, a vinyl ester with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.

.4 The ladder side rail shall be 1-3/4" (44.5mm) square tube with a wall thickness of 1/4" (6.35mm) or greater. The rungs shall be 1-1/4"(31.75mm) diameter pultruded structural shapes, continuously fluted to provide a non-slip surface. Rungs that are gritted as a secondary operation shall not be permitted. Ladder wall and floor mount shall be fabricated from pultruded angles, 3/8"(9.5mm) minimum thickness.

.5 The ladder cage vertical bars shall be 1.5" (38.1mm) wide by 5/8" (15.9mm) pultruded I-beam shapes to offer protection to workers from exposed hardware. Cage hoops and cage brackets shall be manufactured by the open mold hand lay- up process. All cage hoops shall be 3" (76.2mm) wide by 1/4" (6.35mm) thick minimum.

.6 All rungs shall be both mechanically attached to the ladder with stainless steel rivets and chemically bonded with epoxy.

.7 All ladder and cage components are to be integrally pigmented yellow. All wall and floor mount brackets shall be Dynaform® ISOFR dark gray.

.8 All fasteners used in the ladder system are to be 316 SS. Rivets will be 18-8 stainless steel.

.9 For potable water applications, all materials shall be compliant with NSF/ANSI Standard 61.

.4 Structural Shapes

.1 Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Tensile Strength	D-638	30,000 (206)	psi (MPa)
Tensile Modulus	D-638	2.5 x 106 (17.2)	psi (GPa)
Flexural Strength	D-790	30,000 (206)	psi (MPa)
Flexural Modulus	D-790	1.8 x 106 (12.4)	psi (GPa)
Flexural Modulus (Full Section)	N/A	2.8 x 106 (19.3)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	4.5 x 105 (3.1)	psi (GPa)
Coefficient of Thermal Expansion	D-696	4.4 x 10-6 (8.0 x 10 -6)	in/in/°F (cm/cm/°C)
Flame Spread	E-84	25 or less	N/A

.2 Load/Deflection: Structural components shall be designed so that maximum deflection is L/240

.5 Pultruded Grating

.1 Grating components shall be high strength and high stiffness pultruded elements having a maximum of 70% and a minimum of 60% glass content (by weight) of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be interlocked and epoxied in place with a two piece cross rod system to provide a mechanical and chemical lock. Cross rods should be below the walking surface of the grating. Gratings with cross rods that are flush with the walking surface are excluded.

.2 Non-slip surfacing: Grating shall be provided with a quartz grit bonded and baked to the top surface of the finished grating product.

.3 Colour: Dark Gray or Yellow.

.4 Resin shall be VEFR, vinyl ester fire retardant with chemical formulation as necessary to provide the required corrosion resistance, strength and other physical properties. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating corrosion resistance and shall not be accepted.

.5 Load/Deflection: Grating design loads shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be selected based on a uniform load of 4.8kPa or concentrated load of 2.67kN over a 430mm x 430mm area. Deflection is not to exceed 6.35mm.

.6 The manufacturer shall certify that the stiffness of all panels manufactured are never more than 2.5% below the published load-deflection values.

.7 For potable water applications, all materials shall be compliant with NSF/ANSI Standard 61.

2.3 Molded Items

.1 Open Mesh Grating

.1 Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern providing bidirectional strength. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement shall be no more than 1/8" (3.175mm) below the top surface of the

grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements of the CONTRACT.

After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

.2 Resin shall be Isophthalic Polyester with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating product corrosion resistance and shall not be accepted.

.3 All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

.4 All grating products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635. Data generated from testing performed only on the resin shall not be acceptable.

.5 Non–slip surfacing: Grating shall be manufactured with a concave, meniscus profile on the top of each bar providing maximum slip resistance OR provided with a quartz grit bonded and baked to the top surface of the finished grating product.

.6 Grating bar intersections are to be filleted to a minimum radius of 1/16” (1.6mm) to eliminate local stress concentrations and the possibility of resin cracking at these locations.

.7 Colour: Yellow or dark grey

.8 Load/Deflection: Grating design loads shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be designed for a uniform load of 4.8kPa or concentrated load of 2.67kN over a 430mm x 430mm area. Deflection is not to exceed 6.35mm.

.9 The manufacturer shall certify that the stiffness of all panels manufactured are never more than 2.5% below the published load-deflection values.

.10 For potable water applications, all materials shall be compliant with NSF/ANSI Standard 61.

.2 Covered Molded Grating

.1 The grating cover plate shall be attached to the completed panel of grating by chemical means to ensure integral action of the panel and plate. The panel and grating shall be uniformly clamped together to ensure that all contact surface remain in contact throughout the curing process.

.2 Non-slip surfacing: Covered grating shall be provided with a quartz grit bonded and baked on the top surface of the grating cover plate.

.3 Colour: Yellow or dark grey

.4 Load/Deflection: Grating design loads shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be designed for a uniform load of 4.8kPa or concentrated load of 2.67kN over a 430mm x 430mm area. Deflection is not to exceed 6.35mm.

.5 For potable water applications, all materials shall be compliant with NSF/ANSI Standard 61.

Part 3 EXECUTION

3.1 Fabrication

.1 General

.1 All shop fabricated cuts are to be coated with an epoxy sealer to provide maximum corrosion resistance.

.2 Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced at maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

.2 Grating

.1 Measurements: Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

.2 Layout: Manufacturer to provide openings and holes where located on the contract drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.

.3 Structural Shapes

.1 Measurements: Structural Shapes supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or coping from field dimensions before structural shape fabrication.

.2 Sealing: All shop fabricated cuts shall be coated with sealant to provide maximum corrosion resistance. All field fabricated cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

.3 Hardware: Type 316 stainless steel bolts shall be provided.

.4 Concrete Anchors: 316SS anchor bolts with Hilti adhesive anchors shall be provided

.4 Handrail

.1 The handrail post/rail connection is to be fabricated such that the rails are unbroken and continuous through the post without the use of packs or splices. The bottom rail is to be installed through the post at a prepared hole made to fit the outside dimensions of the rail. The top rail is to fit into a machined, u-shaped pocket formed into top of the post such that the rail is located at the center of the post. All exposed post corners are to be radiused to eliminate sharp edges. The rails are to be joined to the post through a combination of bonding and riveting. No sharp, protruding edges are to remain after assembly of the handrail. Spacing of the posts shall not exceed 5'-0" (1.52 m).

.2 The bases of the posts are to be attached according to the contract drawings. The bases of the posts are to be reinforced to a minimum height of 8.5" (254 mm).

.3 When required, rails are to be spliced using a 10" (152.4 mm) length of 1.5" x 1/8" (38.1 mm x 3.2 mm) FRP square tube bonded and riveted into place using epoxy adhesive and 18-8 stainless steel rivets.

.5 Ladders

.1 All ladders and cages shall be designed and laid out in strict accordance with OSHA 1910.27.

.2 B. All rungs shall penetrate the wall of the tube side rails and shall be connected to the rails with both epoxy and rivets to provide both a chemical and mechanical lock, respectively.

.3 Ladders shall be fully shop assembled. Ladder cages shall be test assembled and drilled to ensure a proper fit in the field. Ladder cage brackets shall remain attached to the ladder for shipping, but ladder cage components shall be disassembled, packaged, and shipped separately to ensure the lowest freight costs and to prevent damage in transit. Cage components shall be bundled with each respective ladder.

.4 The hoop brackets shall be shop attached to the ladder with bolts. The hoops shall be field attached to the hoop brackets.

.5 All cut or machined edges, holes and notches shall be sealed to provide maximum corrosion resistance. All field fabricated cuts shall be coated similarly by the contractor in accordance with the manufacturer’s instructions.

3.2 Installation

.1 Contractor shall install materials in strict accordance with manufacturer’s assembly drawings and installation brochure. Fasten grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

END OF SECTION

DIVISION 07

THERMAL AND MOISTURE PROTECTION

Part 1 GENERAL

1.1 Reference Documents

.1 American Society for Testing and Materials (ASTM):

.1 ASTM D1248-16 - Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable

.2 ASTM D4101-14e2 - Standard Specification for Polypropylene Injection and Extrusion Materials

.2 Canada Green Building Council (CaGBC):

.1 LEED Canada 2009 Rating System - LEED Canada for New Construction and Major Renovations. LEED Canada for Core and Shell Development. Website: www.cagbc.org]

.3 Underwriters Laboratories of Canada (ULC):

.1 CAN/ULC-S701.1:2017 - Standard for Thermal Insulation, Polystyrene Boards

.2 CAN/ULC-S702-14 - Standard for Mineral Fibre Thermal Insulation for Buildings

1.2 Administrative Requirements

.1 Sequencing:

.1 Schedule application of insulation to follow immediately after installation of sheet membrane air and vapour seal and to proceed concurrently with it.

1.3 Submittals

.1 Comply with requirements of Division 01.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 Submittal Procedures.

.2 Provide and electronic copy of most recent data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit manufacturers' literature for insulation and fastening systems, indicating compliance with specifications.

.4 Provide an electronic copy of MSDS for all products and indicate VOC content for manufacturer’s recommended mastics.

1.4 Quality Assurance

.1 Certifications:

.1 Polystyrene insulation shall be tested, certified and labelled for conformance with CAN/ULC-S701.1 in accordance with ULC or other certification program accredited by Standards Council of Canada.

1.5 Delivery, Storage, and Handling

.1 Delivery and Acceptance Requirements:

.1 Deliver and store materials, undamaged in original wrappings, in a suitable environment.

.2 Storage and Handling Requirements:

.1 Store to protect materials from wind, moisture, sunlight and accidental ignition.

1.6 Site Conditions

.1 Install insulation during dry weather conditions.

Part 2 PRODUCTS

2.1 Insulation

.1 Polystyrene, Type 2: to CAN/ULC-S701.1.

.2 Polystyrene, Type 3: to CAN/ULC-S701.1, Type 3, except thermal resistance shall meet requirements for Polystyrene, Type 4.

.3 Polystyrene, Type 4: to CAN/ULC-S701.1.

.4 High-Density Polystyrene: same as Polystyrene, Type 4, except compressive strength shall be minimum 275 kPa.

.5 Fibrous Glass: to CAN/ULC-S702, rigid, and as follows:

.1 Thermal Resistance: minimum 0.73 m^2°C/W per 25.4 mm thickness.

.2 Minimum Density: 45 kg/m^3.

2.2 Board Dimensions and Shape

.1 Minimum Width: 400 mm.

.2 Minimum Length: 1200 mm.

.3 Thickness: as indicated in Insulation Schedule.

.4 Insulation applied to curved substrates shall conform to profile without creation of cavities in, or alteration of density of, insulation boards.

2.3 Fasteners

.1 Fasteners shall be specifically designed to anchor insulation by frictional resistance within structurally adequate substrates. They shall be inserted into and compressed against surrounding substrates, either by being driven or screwed, and shall be one of the following types:

.1 Plastic: with integral shank and head of minimum 45 mm diameter to distribute stresses, of high density polyethylene to ASTM D1248 or high density polypropylene to ASTM D4101.

.2 Carbon Steel or Stainless Steel: of nail, screw or expansion type, with separate hot-dip galvanized sheet steel or high density polyethylene or polypropylene stress distribution plates of minimum 50 mm diameter or width.

.3 One of the following combination masonry connectors/insulation fasteners:

.1 Masonry Connectors: designed, with or without optional insulation retainer plates, to function as insulation fasteners.

.2 Plastic Wedges: with locking ribbed surface, designed to secure rigid insulation when installed with ladder type masonry connectors and factory modified to provide rigid anchorage for wedges.

.2 Performance requirements for installed insulation fasteners:

.1 Pullout Resistance: minimum 200 N, perpendicular to applicable substrates and within temperature range of 30°C to +40°C.

.2 Corrosion Resistance: carbon steel components shall show not more than 15% of the surface rusted, and coatings shall not blister, peel or crack, when tested to Corrosion Test Procedure of Factory Mutual Research Approval Standard, Class I Roof Covers (4470).

Part 3 EXECUTION

3.1 Installation of Insulation

.1 Install insulation boards horizontally. Offset vertical joints minimum 300 mm.

.2 Over gypsum sheathing and stud framing at 400 mm o.c., locate vertical joints at mid-point between studs.

.3 Install tightly against dry substrate. Provide continuity of thermal protection to building elements and spaces.

.4 Cut and trim insulation neatly to fit around corners and penetrations. Take care to prevent cutting sheet membrane air and vapour seal.

.5 Butt joints tightly. Deform board edges as required to maintain tight butt joints at insulation fasteners and other penetrations located at board joints.

3.2 Installation of Fasteners

.1 Secure all above grade and partially above grade insulation boards with fasteners, anchored to substrates capable of providing specified fastener pull-out performance. Do not anchor to gypsum sheathing.

.2 Install fasteners following fastener manufacturer's recommendations for type of substrate, drill bits, edge distance, installation methods, and ambient and substrate temperature conditions.

.3 Space fasteners horizontally at:

- .1 maximum 800 mm o.c., and
- .2 minimum 100 mm and maximum 200 mm from vertical board joints.

.4 Space fasteners vertically:

- .1 at all horizontal board joints and on centre line of board widths, or
- .2 at 1/4 of board width from all horizontal joints.

.5 Do not use plastic fasteners in horizontal, suspended installations.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 Provision for batt and blanket insulation including accessories and installation.

1.3 References Standards

.1 ASTM International

.1 ASTM C 553-13(2019), Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C 665-17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.3 ASTM C 1320-20, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.2 Canadian Standards Association (CSA Group)

.1 CSA B111 1974(R2003), Wire Nails, Spikes and Staples.

.2 CSA B149 PACKAGE-20, Consists of B149.1, Natural Gas and Propane Installation Code and B149.2, Propane Storage and Handling Code.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S604-2016, Standard for Factory-Built Type A Chimneys.

.2 CAN/ULC-S702.1-2014, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.3 CAN/ULC-S702.2-2015, Mineral Fibre Insulation for Buildings, Part 2: Application Guidelines.

1.4 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Test Reports:

.1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 Insulation

.1 Batt and blanket mineral fibre: to CAN/ULC-S702.

.1 Type: 1.

.2 Thickness: as indicated.

2.2 Accessories

.1 Insulation clips:

.1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

.2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.

.3 Staples: 12 mm minimum leg.

.4 Tape: as recommended by manufacturer.

Part 3 EXECUTION

3.1 Examination

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation application in accordance with manufacturer's written instructions.

3.2 Insulation Installation

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C 1320.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA B149.1 and CSA B149.2 Type B and L vents.

.5 Do not enclose insulation until it has been inspected and approved by Consultant.

3.3 Cleaning

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 References

.1 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB 19.13M M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
- .2 CAN/CGSB 19.24M M90, Multi Component, Chemical Curing Sealing Compound.
- .3 CGSB 19 GP 14M 84, Sealing Compound, One Component, Butyl Polyisobutylene Polymer Base, Solvent Curing.
- .4 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .5 CAN/CGSB 51.34 M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

.2 Sealant and Waterproofer's Institute Sealant and Caulking Guide Specification.

1.2 Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet and include:
  - .1 Product characteristics.
  - .2 Performance criteria.
  - .3 Limitations.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.4 Quality assurance submittals:

- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

1.3 Quality Assurance

.1 Mock Ups:

- .1 Submit mock ups in accordance with Section 01 45 16 Field Quality Control Procedures
- .2 Construct mock up of sheet vapour barrier installation including one lap joint, and one inside corner. Mock up may be part of finished work.
- .3 Mock-up will be used to judge workmanship, substrate preparation, and material application.
- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock up by Owner’s Representative before proceeding with vapour barrier work.

.2 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

Part 2 PRODUCTS

2.1 Sheet Vapour Barrier

.1 Vapour Retarder: Polyethylene film conforming to CAN2-51.33, Type I, U/V stabilized, 6.0 mil minimum thickness; include pressure sensitive tape of type recommended by vapour retarder manufacturer for sealing joints and penetrations in vapour retarder.

2.2 Accessories

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, cloth fabric duct tape and type recommended by barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealing.

.3 Staples: minimum 6 mm leg.

.4 Moulded box vapour barrier: factory moulded polyethylene box for use with recessed electric switch and outlet device boxes.

Part 3 EXECUTION

3.1 Installation

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall, ceiling, and floor assemblies prior to installation of gypsum board to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 Exterior Surface Openings

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.3 Perimeter Seals

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 Lap Joint Seals

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 Cleaning

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 Factory-finished fiber cement lap siding, panels, shingle, trim, fascia, moulding and accessories; James Hardie HZ5 Engineered for Climate Siding.

1.3 Reference Standards

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C1186-08(2016) - Standard Specification for Flat Fiber-Cement Sheets

.2 ASTM D3359-17 - Standard Test Method for Measuring Adhesion by Tape Test

.3 ASTM E136-19a - Standard Test Method for Assessing Combustibility of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 Submittals

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature, and data sheets for fiber cement siding and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 35 43 – Environmental Procedures.

.4 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

.6 Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

.7 Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 Quality Assurance

.1 Installer Qualifications: Minimum of 2 years experience with installation of similar products.

.2 Mock Ups:

.1 Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

.2 Finish areas designated by Consultant.

.3 Do not proceed with remaining work until workmanship, color, and sheen are approved by Consultant.

.4 Refinish mock-up area as required to produce acceptable work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.6 Delivery, Storage, and Handling

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground on edge or lay flat on a smooth level surface and in accordance with manufacturer's recommendations under cover and in clean, dry, well-ventilated area.

.2 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

.3 Store and protect fiber cement siding from nicks, scratches, and blemishes.

.4 Replace defective or damaged materials with new.

1.7 Project Conditions

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 Warranty

.1 Product Warranty: Limited, non-pro-rated product warranty.

.1 HardiePlank HZ5 lap siding for 30 years.

.2 HardiPanel HZ5 vertical siding for 30 years.

.3 HardieSoffit HZ5 panels for 30 years.

.4 HardieShingle HZ5 siding for 30 years.

.5 Artisan HZ5 lap siding for 30 years.

.2 Product Warranty: Limited, product warranty.

.1 HardieTrim HZ and HZ5 boards for 15 years.

.3 Finish Warranty: Limited product warranty against manufacturing finish defects.

.1 When used for its intended purpose, properly installed and maintained according to James Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

.4 Workmanship Warranty: Application limited warranty for 2 years.

Part 2 PRODUCTS

2.1 Manufacturers

.1 Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400 ; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Fax: 949-367-4981; Email: request info (info@jameshardie.com); Web: www.jameshardiepros.com.

.2 Substitutions: Not permitted.

2.2 Siding

.1 HardiePlank HZ5 lap siding, HardiPanel HZ5 vertical siding, HardieSoffit HZ5 panels and HardieShingle HZ5 siding requirement for Materials:

.1 Fiber-cement Siding - complies with ASTM C 1186 Type A Grade II.

.2 Fiber-cement Siding - complies with ASTM E 136 as a noncombustible material.

.3 Fiber-cement Siding - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.

.4 CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.

.5 National Evaluation Report No. NER 405 (BOCA, ICBO, SBCCI, IBC, IRC).

.6 City of Los Angeles, Research Report No. 24862.

.7 Miami Dade County, Florida Notice of Acceptance 07-0418.04.

.8 US Department of Housing and Urban Development Materials Release 1263d.

.9 California DSA PA-019.

.10 City of New York M EA 223-93-M.

.11 Florida State Product Approval FL889.

.12 Texas Department of Insurance Product Evaluation EC-23.

.2 Lap Siding: HardiePlank HZ5 Lap siding as manufactured by James Hardie Building Products, Inc.

.1 Type: Beaded Smooth 8-1/4 inches (210 mm) with 7 inches (178 mm) exposure.

.3 Trim:

.1 HardieTrim HZ5 boards and HardieTrim HZ boards as manufactured by James Hardie Building Products, Inc.

2.3 Fasteners

.1 Wood Framing Fasteners

.1 Wood Framing: 0.093 inch (2.4 mm) shank by 0.222 inch (5.6 mm) head by 2 inches (51 mm) corrosion resistant siding nails.

2.4 Finishes

.1 Factory Finish:

.1 Product: ColorPlus Technology by James Hardie.

.2 Definition: Factory applied finish; defined as a finish applied in the same facility and company that manufactures the siding substrate.

.3 Process:

.1 Factory applied finish by fiber cement manufacturer in a controlled environment within the fiber cement manufacturer's own facility utilizing a multi-coat, heat cured finish within one manufacturing process.

.2 Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photospectrometer and verified by third party.

.4 Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed

.5 Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer.

.2 Factory Finish Color for Trim, and Siding Colors:

.1 Siding: Monterey Taupe JH40-20

.2 Trim: Iron Gray JH90-30

Part 3 EXECUTION

3.1 Examination

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fiber cement siding installation in accordance with manufacturer's written instructions.

.2 If framing preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

3.2 Preparation

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

.3 Install a water-resistive barrier as required in accordance with local building code requirements.

.4 The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

.5 Install Engineered for Climate HardieWrap weather barrier in accordance with local building code requirements.

.6 Use HardieWrap Seam Tape and joint and laps.

.7 Install HardieWrap flashing, and HardieWrap Flex Flashing

3.3 Installation Hardieplank HZ5 Lap Siding

.1 Install materials in strict accordance with manufacturer's installation instructions.

.2 Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

.3 Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

.4 Align vertical joints of the planks over framing members.

.5 Maintain clearance between siding and adjacent finished grade.

.6 Locate splices at least one stud cavity away from window and door openings.

.7 Wind Resistance: Where a specified level of wind resistance is required Hardieplank lap siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.

.8 Locate splices at least 12 inches (305 mm) away from window and door openings.

3.4 Installation – Hardietrim HZ5 Boards

.1 Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.

.2 Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

.3 Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.

.4 Maintain clearance between trim and adjacent finished grade.

.5 Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.

.6 Allow 1/8 inch gap between trim and siding.

.7 Seal gap with high quality, paint-able caulk.

.8 Shim frieze board as required to align with corner trim..

3.5 Protection

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

3.6 Cleaning

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.1 Remove fiber cement siding material dropped during installation and leave work area clean.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 Roofing installation using steel sheet metal.

1.3 Reference Standards

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A 167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A 240/A 240M-20a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A 653/A 653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A 792/A 792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.5 ASTM B 32-20, Standard Specification for Solder Metal.

.6 ASTM B 370-12(2019), Standard Specification for Copper Sheet and Strip for Building Construction.

.7 ASTM D 523-14(2018), Standard Test Method for Specular Gloss.

.8 ASTM D 822/D822M-13(2018), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.

.2 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.

.3 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.4 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.3 Canadian Standards Association (CSA Group)

.1 CSA A123.3-05(2015), Asphalt Saturated Organic Roofing Felt.

.4 Department of Justice

.1 Canadian Environmental Protection Act (CEPA), 1999.

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

.1 Safety Data Sheets (SDS).

.6 National Building Code of Canada 2015 (NBC)

.1 CCMC- Registry of Product Evaluations.

.7 Transport Canada

.1 Transportation of Dangerous Goods Act (TDGA), 1992.

1.4 Submittals

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature, and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Proof of manufacturer’s CCMC listing and listing number.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 35 43 – Environmental Procedures.

.3 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.4 Shop Drawings: Provide detailed drawings of atypical non-standard applications of sheet metal roofing which are outside the scope of the standard details and specifications provided by the manufacturer.

.5 Samples: Submit two 300 x 300 mm samples of each sheet metal material.

1.5 Quality Assurance

.1 Installer Qualifications: Minimum of 2 years experience with installation of similar products.

.2 Mock Ups:

.1 Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

.2 Finish areas designated by Consultant.

.3 Do not proceed with remaining work until workmanship, color, and sheen are approved by Consultant.

.4 Refinish mock-up area as required to produce acceptable work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.6 Delivery, Storage, and Handling

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations under cover and in clean, dry, well-ventilated area.

.2 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

.3 Store and sheet metal roofing from nicks, scratches, and blemishes.

.4 Replace defective or damaged materials with new.

1.7 Project Conditions

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

Part 2 PRODUCTS

2.1 Sheet Metal Materials

.1 Zinc coated steel sheet: to ASTM A 653/A 653M, commercial quality, with Z275 coating, regular spangle, surface, prefinish as specified, 0.378 mm minimum base metal thickness.

2.2 Prefinished Steel Sheet

.1 Prefinished steel with factory applied silicone modified polyester.

- .1 Class F1S.
- .2 Colour per finish schedule.
- .3 Specular gloss: 30 units +/-5 to ASTM D 523.
- .4 Coating thickness:25 micrometres minimum.
- .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D 822 as follows:
  - .1 Outdoor exposure period 1000 hours minimum.
  - .2 Humidity resistance exposure period 1000 hours minimum.

2.3 Accessories

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB-37.5.

.3 Underlay: Lastobond Shield HT by Soprema or approved equivalent.

.4 Slip sheet: reinforced sisal paper or a heavy felt kraft paper.

.5 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer. Caulking see Section 07 92 00 - Joint Sealants.

.6 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.

.7 Cleats: of same material, and temper as sheet metal: 50 mm minimum wide.

.8 Fasteners: Woodgrip Screws #9 x 1” (25.4 mm) colour matched, exposed.

.9 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.10 Solder: to ASTM B32

.11 Flux: rosin, cut muriatic acid, or commercial preparation suitable for materials to be soldered.

.12 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.4 Fabrication

.1 Make allowances for expansion at joints.

.2 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.3 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

Part 3 EXECUTION

3.1 Examination

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.

.2 If framing preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

3.2 Installation

.1 Include underlay under sheet metal roofing.

.1 Secure in place and lap joints 100 mm minimum.

.2 Apply slip sheet over underlay to prevent bonding between sheet metal and felt.

.1 Secure with anchorage and lap joints 50 mm minimum in direction of waterflow.

.3 Install sheet metal roof panels per manufacturers installation recommendations and form seams in direction of water-flow and make watertight.

.4 Do not screw top sheet of roofing until ridge cap is applied, then screw through both the ridge cap and the sheet at the high part of the rib.

.5 Overlap sheets by at least 150 mm and lay sheets one by one from eace to ridge before starting new row.

.6 Do not secure all fasteners on panel until sheet has been laid and squared, to ensure an even application of all sheets.

.7 Extend ends of roof sheets 25 mm past finished sidewall fascia and soffit.

.8 Stagger transverse seams in adjacent panels.

.9 Flash roof penetrations with material matching roof panels, and make watertight.

3.3 Cleaning

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 Protection

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 Custom sheet metal fabrications including roof flashings, base and counter flashings, wall transition flashings, flashings at openings, closures and trim, vent pipe and chimney flashings, and similar sheet metal fabrications in connection with roofing and wall cladding. Products may be fabricated using prefinished steel, galvanized steel, or stainless steel.

1.3 ReferenceStandards

.1 ASTM International

.1 ASTM A 240/A 240M-16, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM A 606/A 606M-15, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

.3 ASTM A 653/A 653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A 755/A 755M-16e1 Standard Specification for Steel Sheet, Metallic coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

.5 ASTM A 792/A 792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.6 ASTM B 32-08(2014), Standard Specification for Solder Metal.

.7 ASTM B 209-14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.8 ASTM B 370-12, Standard Specification for Copper Sheet and Strip for Building Construction.

.9 ASTM D 523-14, Standard Test Method for Specular Gloss.

.10 ASTM D 1970/D 1970M-15a Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.11 ASTM D 4587-11 Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.

.12 ASTM F 1667-15 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.3 Canadian Roofing Contractors Association (CRCA)

.4 .1 Roofing Specifications Manual 2012.

.5 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI S8-2008 Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.

.2 CSSBI B17-2002 Barrier Series Prefinished Steel Sheet: Product Performance & Applications.

.3 CSSBI Sheet Steel Facts #12 2003 Fastener Guide for Sheet Steel Building Products. CGSB 37.5-M89 “Cutback Asphalt Plastic Cement".

.6 Canadian Standards Association (CSA Group)

.1 CSA A123.3-05(2015), Asphalt Saturated Organic Roofing Felt.

.2 CSA A123.22-08(2013) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.7 FM Global

.1 Property Loss Prevention Data Sheets 1-49 Perimeter Flashing.

.8 Green Seal Environmental Standards

.1 Standard GS-11-2015, Paints, Coatings, Stains, and Sealers.

.2 Standard GS-36-2013, Adhesives for Commercial Use.

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

.1 Safety Data Sheets (SDS).

.10 Sheet Metal and Air Conditioning Contractors Association of North America (SMACNA)

.1 Architectural Sheet Metal Manual (2012)

.2 Residential Sheet Metal Guidelines (2001)

1.4 Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature including product specifications and technical data sheets for sheet metal flashing fasteners and accessory materials. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS SDS - Safety Data Sheets in accordance with Section 01 35 43 - Environmental Procedures

.3 Shop Drawings:

.1 Submit shop drawings for all sheet metal fabrications.

.2 Indicate sheet thickness, flashing dimensions and fastenings. Include anchorage, expansion joints and other provisions for thermal movement.

.3 Submit manufacturer's catalogue cut sheets for manufactured items.

.4 Samples:

.1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colour.

1.5 Pre-Installation Meeting

.1 Include sheet metal flashing and trim on agenda of pre-installation meetings of affected sections.

1.6 Mock-Ups

.1 Include flashings in mock-ups as specified for work of other affected sections.

1.7 Delivery, Storage, and Handling

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

.2 Handle and store flashing materials to prevent creasing, buckling, scratching, or other damage.

.3 Waste Management and Disposal:

.4 Separate waste materials for in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.8 Warranty

.1 Provide the Owner with an ARCA "Certificate of Assurance" stating that the metal flashings will properly shed water and protect felts from physical damage for a minimum of two (2) years from date of Substantial Performance of work.

Part 2 PRODUCTS

2.1 Base Sheet Metal Materials

.1 Provide sheet metal in base metal thickness specified. Where no thickness specified, provide base sheet metal in thickness recommended in SMACNA Architectural Sheet Metal Manual for type of item being fabricated, but not less than the thickness required by the authority having jurisdiction.

.2 Zinc coated steel sheet: 0.455 mm minimum thickness, commercial quality to ASTM A 653/A 653M, with Z275 designation zinc coating.

2.2 Prefinished Steel Sheet

.1 Prefinished steel sheet with coating system consisting of base metal pre-treatment, primer, silicone modified polyester or polyester topcoat meeting requirements of CSSBI S8.

.2 Finished one side with wash coat and primer on back.

.3 Colour per finish schedule.

.4 Specular gloss: 30 units +/- 5 gloss units in accordance with ASTM D 523.

.5 Exposed coating thickness: dry film coating system thickness not less than 22 micrometres.

2.3 Accessories

.1 Isolation coating: alkali resistant bituminous paint.

.2 Pourable sealer: proprietary two-part polyurethane pourable sealer designed for sealing penetration pockets.

.3 Loose laid underlay for metal flashing: dry sheathing to CAN/CGSB-51.32.

.4 Self-adhesive membrane underlay and tie-in membrane for metal flashings: To CSA A123.22 or ASTM D 1970.

.5 Sealants: in accordance with Section 07 92 00, in colour to match flashing finish colour.

.6 Cleats and hook strips: of same material, and temper as sheet metal, minimum 50 mm wide/one-third width of secured flashing. Thickness same as sheet metal being secured.

.7 Nails: of same material as sheet metal, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.8 Screws: of same material as sheet metal, Suitable for substrate and material being fastened, galvanized coloured head, neoprene washer.

.9 Solder: to ASTM B 32

.10 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.

.11 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 Fabrication

.1 Fabricate metal flashings in accordance with recommendations of CRCA and as indicated on Drawings.

.2 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.3 Form sections at 2.4 m lengths. Make allowances for expansion at joints.

.4 All seams are to be flat lock type except corners. Fabricate corners minimum 500 mm x 500 mm, mitred, soldered or welded, and sealed as one piece.

.5 Wipe and wash clean, all soldered joints, to remove traces of flux immediately after soldering.

.6 Hem exposed edges of flashings on underside 12 mm.

.1 Mitre and seal corners with sealant.

.7 Fabricate flashings to allow toe to extend minimum 50 mm horizontally over roofing, and return brake edge.

.8 Form plastic pans watertight, with minimum 60 mm upstand and 100 mm flanges. Form pans minimum 150 mm wider than member passing through roof membrane.

.9 Backpaint flashings with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

Part 3 EXECUTION

3.1 Manufacturer’s Instructions

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 Installation

.1 Install flashings in accordance with CRCA recommendations and as indicated on Drawings.

.2 Secure flashings in place using specified type fasteners. Use exposed fasteners in locations approved by Consultant. When using exposed fasteners, they are to be of same finish as flashings.

.3 Apply sealing compound at junction of metal flashings and asphalt felt flashings.

.4 Lock seams and end joints. Fit flashings tight in place. Make corners square, surfaces true and straight in all places, and all lines accurate to profiles.

.5 Install plastic pans where indicated on drawings. Fill pans with plastic cement.

.6 Counter-flash all mechanical and electrical items projecting through membrane roofing.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 GENERAL

1.1 References

.1 The Aluminum Association Inc. (AA)

.1 Aluminum Sheet Metal Work in Building Construction.

.2 AA DAF45, Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials (ASTM International)

.1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.3 ASTM D523, Standard Test Method for Specular Gloss.

.4 ASTM D822, Standard Practice for Filtered Open Flame Carbon Arc Exposures of Paint and Related Coatings.

.3 Canadian General Standards Board (CGBS)

.1 CAN/CGSB 37.5, Cutback Asphalt Plastic Cement.

.4 Canadian Standards Association (CSA International)

.1 CSA B111, Wire Nails, Spikes and Staples.

1.2 Submittals

.1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.

.2 Clearly indicate bending, folding, jointing, fastening installation details.

1.3 Delivery and Storage

.1 Store products off ground and under cover in a dry, well ventilated enclosure.

.2 Stack pre formed material in manner to prevent twisting, bending and rubbing.

.3 Provide protection for galvanized and pre coated surfaces.

.4 Prevent contact of dissimilar metals during storage. Protect from acids, flux, and other corrosive materials and elements.

Part 2 PRODUCTS

2.1 Materials

.1 Sheet aluminum 0.64 mm thick. Color as selected by Owner’s Representative.

.2 Trough size: 125 mm wide.

.3 Trough Supports: continuous aluminum with a perforated aluminum cover that covers the complete trough to prevent debris from getting stuck in the trough and downpipe.

.4 Downpipes: 0.64 mm thick aluminum.

.5 Downpipe straps: 0.72 mm thick aluminum.

.6 Sealant: As per Section 07 92 00 – Joint Sealants.

.7 Elbows and tees: aluminum same as trough.

2.2 Fabrication

.1 Fabricate sheet aluminum work in accordance with Aluminum Association Aluminum Sheet Metal Work in Building Construction.

.2 Fabricate eavestrough in continuous length up to a maximum length of 12 metres.

.3 Form eavestrough to an Ogee profile, 125 mm wide and a 305 mm girth.

Part 3 EXECUTION

3.1 Installation

.1 Install trough supports/debris catchers to provide a continuous slope to drain all water from the trough.

.2 Cut opening in the trough to receive the downpipes.

.3 Install the trough and snap in to the supports (no exposed screws or nails permitted). Install elbows and tees as required. Provide for expansion joints to prevent warping where required.

.4 Install aluminum downpipes to a distance of 1.5 metres from the grade. Install aluminum straps 1200 mm o.c designed to match the pipe profile and fasten to building with aluminum or stainless steel screws.

.5 Install sewer type downpiping from the aluminum downpiping to a point 300 mm above the grade. Install aluminum straps designed to suit the pipe profile and fasten to the wall with aluminum or stainless steel screws.

.6 Install sealant as required to ensure all joints are watertight.

.7 When work is completed, provide a water test to ensure there are no leaks and that all the water runs from the trough.

3.2 Cleaning

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Leave works areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Section includes, but is not limited to:

.1 Preparation of surface to be sealed, supplication and cleaning using various types of joint sealants.

1.3 Reference Standards

.1 ASTM International

.1 ASTM C510-16, Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.

.2 ASTM C639-15, Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants

.3 ASTM C717-19 Standard Terminology of Building Seals and Sealants.

.4 ASTM C719-14(R2019), Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).

.5 ASTM C792-15, Standard Test Method for Effects of Heat Aging on W eight Loss, Cracking, and Chalking of Elastomeric Sealants.

.6 ASTM C794-18, Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

.7 ASTM C834-17, Standard Specification for Latex Sealants.

.8 ASTM C919-19, Standard Practice for Use of Sealants in Acoustical Applications.

.9 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.

.10 ASTM C1016-14, Standard Test Method for Determination of Water Absorption of Sealant Backing (Joint Filler) Material

.11 ASTM D1056-14, Standard Specification for Flexible Cellular Materials - ;Sponge or Expanded Rubber

.12 ASTM C1083-06(2015), Standard Test Method for Water Absorption of Cellular Elastomeric Gaskets and Sealing Materials.

.13 ASTM C1087-16, Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing System s.

.14 ASTM C1135-19, Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.

.15 ASTM C1184-18e1, Standard Specification for Structural Silicone Sealants

.16 ASTM C1193-16, Standard Guide for Use of Joint Sealants.

.17 ASTM C1247-14, Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.

.18 ASTM C1248-18, Standard Test Method for Staining of Porous Substrate by Joint Sealants.

.19 ASTM C1249-18, Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications.

.20 ASTM C1253-14, Standard Test Method for Determining the Outgassing Potential of Sealant Backing.

.21 ASTM C1311-14, Standard Specification for Solvent Release Sealants.

.22 ASTM C1330-18, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.23 ASTM C1375-00(2014), Standard Guide for Substrates Used in Testing Building Seals and Sealants.

.24 ASTM C1382-16, Test Method for Determining Tensile Adhesion Properties of Sealants W hen Used in Exterior Insulation and Finish System s (EIFS) Joints.

.25 ASTM C1401-14, Standard Guide for Structural Sealant Glazing.

.26 ASTM C1442-14, Standard Practice for Conducting Tests on Sealants Using Artificial Weathering Apparatus.

.27 ASTM C1472-16e1, Standard Guide for Calculating Movement and Other Effects W hen Establishing Sealant Joint Width.

.28 ASTM C1520-02(2015)e1, Standard Guide for Paintability of Latex Sealants.

.29 ASTM C1589/C1589M-18, Standard Practice for Outdoor Weathering of Construction Seals and Sealants.

.30 ASTM D2203-01(2018), Standard Test Method for Staining from Sealants.

.31 ASTM D2240-15e1, Standard Test Method for Rubber Property - ;Durometer Hardness

.32 ASTM D5249-10(2016), Standard Specification for Backer Material for Use with Cold- and Hot- Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200-[E(2)1993], Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

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

.1 Safety Data Sheets (SDS).

.5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.4 Qualifications

.1 Perform Caulking using parties locally recognized for ability in the trade, having at least five (5) years proven satisfactory experience, to carry out the work and/or supervise skilled mechanics thoroughly trained and competent in the use of caulking and sealing materials using pressure operated equipment.

.2 Perform Work in accordance with the sealant manufacturer's requirements for preparation of surfaces and materials installation instructions.

1.5 Submittals

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Samples

.1 Submit 2 samples of each type of material and colour.

.2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer’s Instructions

.1 Submit instructions to include installation instructions for each product used.

1.6 Closeout Submittals

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.7 Delivery, Storage, and Handling

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.8 Environmental Conditions

.1 Do not work at temperatures greater or less than those recommended by the manufacturer.

.2 Maintain air temperature range of 4°C to 27°C in areas to receive sealants, 24 hours before, during application, and until sealants have cured.

.3 Should it become necessary to apply sealants at temperatures below or above this range, advise the Owner’s Representative and consult sealant manufacturer and follow the latter's recommendations.

.4 Protect all work against dam age and disfigurations and work of other trades against soiling and dam age arising out of this work. Upon completion, replace and repair all defective work.

.5 Examine substrate materials, joint voids, and note temperature/humidity conditions. Report unacceptable conditions to the Owner's Representative. Do not apply sealants on unacceptable substrates.

.6 Commencement of work implies acceptance of conditions.

1.9 Safety Requirements

.1 Com ply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada and Alberta Occupational Health and Safety.

.2 Ventilate area of work as using acceptable portable supply and exhaust fans.

1.10 Compatibility

.1 Ensure that all materials used are compatible.

.2 Declaration of Materials Compatibility: Submit written declaration stating that sealant materials are compatible with adjacent materials and substrates and are acceptable to the sealant manufacturer. Include a list of materials, suppliers and manufacturers.

1.11 Guarantee

.1 Provide a material manufacturer's written guarantee endorsed and issued in the name of the Owner stating that all sealant and caulking work is guaranteed against leakage, sealants that do not properly cure, cracking and deterioration, shrinkage, loss of cohesion, loss of adhesion, staining of adjacent surfaces, integral staining or failure to provide intended seal; for a period of five (5) years from date of Substantial Performance of the contract and that any defects will be replaced including related materials at no cost to the Owner.

.2 Provide an installers written five (5) year warranty to repair or replace caulking and sealants which, in the Owner's Representatives opinion, fail to provide airtight or watertight joints, fail in adhesion, cohesion and abrasion, weather, extrusion, migration, resistance and stain resistance, general durability or appear to deteriorate.

Part 2 PRODUCTS

2.1 Materials

.1 Note: all exterior sealants to have matte finish; high gloss finish will not be acceptable.

.2 **Sealant Type 1:** one component silicone sealant to ASTM C920, type 2, Class 25, shore A hardness of 25 - 30, non sag, neutral curing, one of the following:

.1 Dow Corning 795.

.2 GE Silpruf.

.3 Other preapproved product.

.3 **Sealant Type 2:** one component paintable silicone rubber sealant conforming to ASTM C920, Dow Corning 8644 or preapproved product.

.4 **Sealant Type 3** (horizontal joint sealant): multi component, chemical curing, self levelling, polyurethane sealant, conforming to ASTM C920, type M, Grade P, Class 25, One of the following:

.1 Tremco "THC-900".

.2 Sikaflex 2C/SL.

.3 Iso-flex 880 GB.

.4 Vulkem 245.

.5 Other preapproved product.

.5 **Sealant Type 4:** one component, mildew resistant, silicone rubber sealant, conforming to CAN/CGSB-19.22. Dow Corning 786. Acceptable alternative substitutions will be considered. Refer to Division 1.

.6 Acoustical sealant: Low VOC type to ASTM C920.

.7 Joint Cleaner: Non-corrosive solvent recommended by sealant manufacturer for applicable substrate materials.

.8 Primer: Non-staining type recommended by sealant manufacturer.

.9 Joint Filler: Round closed cell, non-staining, non-absorbent foam, extruded polyethylene shore hardness 20, tensile strength 138-207 KPa outsized 30-50%. For backup to large joints, cavities or voids, use fibreglass wool.

.10 Bond Breaker: Pressure sensitive polyethylene tape, not bondable to sealant.

2.2 Colours

.1 Colours: to match adjacent material, as selected by the Owner’s Representative.

Part 3 EXECUTION

3.1 Preparation

.1 Surface Cleaning: C lean all surfaces required to be caulked, removing all loose particles, dust, oil, wax, protective coatings, mould release agents, and the like, using brush, solvents, or acid etching methods.

.2 Primer Application: Prior to application of primer where required, test primers for possible yellowing, discolouration, and dirt pick-up when applied over face of porous substrates.

.3 Following testing apply primers to joints following manufacturer's recommendations.

.4 When tests indicate discolouration, dirt pick-up and the like on surfaces, take special precautions when applying, by m asking surfaces not required to be primed.

.5 Ensure that the sealant manufacturer's representative reviews site conditions, joint design and installers qualifications. Report unsatisfactory conditions to the Owner’s Representative. Ensure that sealants are compatible with adjoining materials.

.6 Ensure that the sealant manufacturer's representative checks container labels, random inspect preparation of substrate materials and random test installed work.

3.2 Application - General

.1 Use sealant Type 1 for exterior caulking except where indicated otherwise.

.2 Apply foam bead to within 10 mm of face of joint.

.3 Ensure all surfaces are clean. Caulk only when surface temperature is between 4°C and 27°C.

.4 Apply sealant in accordance with manufacturer's instructions.

.5 Use pressure gun fitted with suitable nozzle.

.6 Ensure finished surfaces of sealant are smooth and free from ridges, wrinkles, or foreign matter.

.7 Prime joints when recommended by manufacturer. Use a brush that will reach all parts of the joints.

.8 Wire brush loose surfaces (such as masonry).

.9 Caulk interior joints using sealant type 2, before final coat of paint is applied to adjacent work.

.10 Ensure bead is solid, filling entire space between sides and bedding material, and exerting sufficient pressure on sides to obtain maxim um bond, by allowing sealant to bulge out in advance of nozzle.

3.3 Application of Sealants

.1 Apply sealants in accordance with manufacturer's directions, using a pressure air gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.

.2 Apply **Sealant Type 1** to exterior at joints between dissimilar materials, control joints, around exterior louvres, around door and window installations, hollow metal door frames to all other exterior joints to render areas of application weather tight. Caulk around hose bibs and similar penetrations through exterior walls. Caulk both inside and outside of perimeter of openings where penetrations through the exterior envelope of doors or windows occur. Apply Sealant Type 1 to all locations required to be bedded in caulking com pound where not exposed to view, such as below thresholds, bedding where called for, in joints and elsewhere as required. Apply sealant to exterior at joints between dissimilar materials, expansion and control joints, concrete and masonry and to all other exterior joints to render areas of application weather tight.

.3 Use **Sealant Type 2** to all other joints to interior such as between dissimilar materials around door frames and between drywall and dissimilar materials. Apply sealant prior to painting. Allow sealant to cure properly prior to paint application. Use for all acoustic applications.

.4 Apply traffic grade **Sealant Type 3** around openings and joints in floor slabs, including sawcuts, and where slabs abut foundation walls to provide a continuous watertight joint.

.5 Apply **Sealant Type 4** around pipes and washroom fixtures, to backsplashes, showers and other wet areas to provide a continuous watertight joint.

.6 Joint Design: Fill all spaces that are deeper than width of joint, with approved backup material. Ensure that the backup material fills the joint out to a dimension that is equal to the width of the joint, but in no case less than half the width of the joint.

.7 Sealant Application: Gun apply sealants through a nozzle opening of such shape and diameter that the full bead of sealant is gunned into the joint, filling the joint completely; to the approval of the Owner’s Representative.

.8 A superficial or skin bead in joints will not be acceptable.

.9 Tool all beads immediately after application to ensure firm, full contact with the inner faces of the joint. Strike off excess material with tooling stick or knife.

.10 Upon completion, ensure caulking surfaces are smooth, even, free from ridges, wrinkles, air pockets, and embedded foreign matter.

.11 Joint Finishes: Finish joints in flush surfaces; fill joints full in internal angles, except as otherwise detailed. Use wet tool as required. Avoid the use of face fillet (or angle bead) joints. CONCAVE OR CONVEX JOINTS WILL BE REJECTED.

.12 Where sharp, exact bead lines are desired, use m asking tape. W hen taping, avoid touching cleaned and primed areas to which sealant is to be applied. Remove masking tape immediately after bead is placed and tooled, to avoid dam age to developing surface skin.

.13 Completely fill void with compound into which they are installed. Remove excess immediately following installation.

3.4 Acoustic Sealant

.1 Apply backing materials and sealants according to the manufacturer's guidelines and to the requirements of ASTM C919 to achieve a uniform, minimum 6 mm thick bead and to achieve an airtight and light-tight seal. Unless additional beads are specified in the Contract Drawings, seal all acoustically-rated assemblies around their perimeter with at least two beads of acoustical sealant.

.1 Install backer rod in all joints greater than 6 mm wide.

.2 Fill joints with glass- or mineral-fiber insulation to the full depth of the wall, slab, or ceiling construction.

.2 For pipe, conduit, and duct penetrations, form wall and floor/ceiling penetrations to the size and shape of the each penetrating element with a 19 mm to 25 mm (¾" to 1") wide annular space around the element. Provide a separate opening for each penetrating element. Multiple elements within a single opening are prohibited without express consent of the Architect and Acoustics Owner's Representative.

.1 For solid masonry and concrete walls and slabs, form or cut rectangular openings for rectangular ductwork, cable trays, and similar elements. Grout masonry cells or use solid masonry units at wall openings.

.2 For solid masonry and concrete walls and slabs, core-drill openings for pipes, conduit, and similar penetrating elements.

.3 For hollow gypsum board walls, frame rectangular openings for rectangular penetrating elements. Support the cut gypsum board edges on all four sides of the opening with metal stud framing.

.4 For hollow gypsum board walls, core-drill openings of required size for pipes, conduit, and similar penetrating elements, or provide either solid wood blocking within the wall cavity or0.76 mm (22ga) sheet metal sleeves that are firmly bedded into the wall construction with joint com pound.

.1 Provide sleeves that protrude at least 25 mm (1") from each face of the wall.

.2 Seal protruding sleeve to each face of the wall with a fillet of resilient sealant.

.3 Fill annular space between sleeve and penetrating element with glass- or mineralfiber insulation and install backer rod and sealant as specified above.

.5 Seal the bases, heads and ends of all walls in Acoustically Sensitive Room s, Electrical Equipment Room s of all types, Mechanical Equipment Room s of all types and Elevator Equipment Room s of all types to achieve an airtight and light tight closure.

.6 Seal all gaps between window frames and wall systems and between door frames and wall system s in Acoustically Sensitive Rooms, Electrical Equipment Room s of all types, Mechanical Equipment Room s of all types and Elevator Equipment Room s of all types to achieve an airtight and light tight closure.

.7 Electrical boxes, electrical conduits, pipes, ducts, structure and other penetrations of walls, floors and slabs within Acoustically Sensitive Room s, Electrical Equipment Room s of all types, Mechanical Equipment Room s of all types and Elevator Equipment Room s of all types shall be caulked to achieve an airtight and light tight closure.

.1 For electrical boxes, audio and video panels, fire extinguisher cabinets, HVAC system control devices, and similar elements recessed into acoustically- sensitive partitions or where backboxes serving adjacent room s but located in the same partition within the same stud space,

wrap entire concealed surface with intumescent putty to form airtight, light-tight closure of the entire surface of the backbox extending to and bonding with the back face of the adjacent gypsum board or other wall cladding. Install in compliance with manufacturer's recommendations.

3.5 Bond Breaker

.1 Use foam bead as specified, to limit depth of sealant and to act as bond breaker at back of joint (adhesion is not required at back of joint).

.2 Where depth of joint does not perm it the use of foam bead, apply paper m asking tape to the back of the joint to act as bond breaker.

3.6 Cleaning

.1 Promptly as work proceeds remove all excess material or smears from surfaces beyond joint or surface to be caulked, using solvents as recommended by the manufacturer's representative. If sealant or caulking has set up, employ mechanical rem oval.

.2 During application, maintain areas of work in clean condition daily removing from the premises and site all rubbish and surplus material.

.3 Clean immediately soiled non-porous materials.

.4 On porous surfaces, remove any excess sealant as recommended by manufacturer.

3.7 Protection

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

DIVISION 08

OPENINGS

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Hollow metal doors (steel).

.2 Hollow metal door frames (steel).

.3 Hollow metal frames for glazed openings (steel).

.4 Fire rated hollow metal doors and frames.

.5 Steel reinforcing within hollow metal frames.

.6 Pressure grouting of frames in interior concrete walls.

1.3 Reference Standards

.1 ULC: List of Equipment and Materials.

.2 ASTM A568/A568M -13: Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

.3 ASTM A653/A653M -11: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A924/A924M -13: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.5 ASTM D3678 -97(2008)e1: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Interior-Profile Extrusions

.6 CAN/ULC-S104 -10: Standard Method for Fire Tests of Door Assemblies

.7 CAN/ULC-S105 -09: Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

.8 ULC CAN4-S106 -M80(R1985): Standard Method for Fire Tests of Window and G lass Block Assemblies

.9 ULC S135 -04: Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter), Includes Amendment 1.

.10 NFPA (Fire) 252: Fire Tests of Door Assemblies, 2012 Edition

.11 NFPA (Fire) 80: Standard for Fire Doors and Other Opening Protectives, 2013 Edition

.12 CSA W 59 -03 (R2008): Welded Steel Construction (Metal Arc Welding)

.13 NAAMM: Hollow Metal Manual

.14 NAAMM HMMA 850 -00: Fire Rated Hollow Metal Doors & Frames

.15 CSDMA - Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000.

.16 CSDMA - Recommended Selection and Usage Guide for Steel Doors and Frames, 2009.

.17 CSDMA - Storage and Installation Guide 2012

.18 CSDMA - Specifications for Commercial Steel Doors & Fames, 2009

.19 BHMA A156.115 -2006: Hardware Preparation in Steel Doors and Steel Frames

.20 DHI Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

.21 The Society for Protective Coatings (SSPC):

- .1 SSPC 02-14: Steel Structures Painting Manual, Volume 1, Good Painting Practice.
- .2 SSPC 05-03: Surface Preparation Specifications and Practices
- .3 SSPC 08-02: Steel Structures Painting Manual
- .4 SSPC Paint 15: Steel Joist Shop Primer/Metal Building Primer (Includes 2004 Revisions)
- .5 SSPC Paint 20: Zinc-Rich Coating (Type I - Inorganic and Type II - Organic) (Includes 2004 Revisions)
- .6 SSPC SP 1: Solvent Cleaning, Includes Editorial Revisions (2004)
- .7 SSPC SP 2: Surface Preparation Specification No. 2: Hand Tool Cleaning, Includes Editorial Revisions (2004)
- .8 SSPC SP 6 / NACE No. 3: Commercial Blast Cleaning

.22 If requested by the Owner’s Representative provide a PDF digital copy of any or all of the Standards above as selected by the Owner’s Representative at no additional cost.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Division 1.

.2 Fully describe and locate all item s being furnished and include large scale details of principle construction features. Show dimensions in metric units.

.3 Indicate each type of door, frame, steel, core and material thickness, mortises, reinforcements, anchorages, locations of exposed fasteners, openings glazed, paneled or louvred and arrangement of hardware. Show the top edge fillers to exterior doors. Show reinforcement for hardware.

.4 Indicate all door hardware mounting heights and locations. DO NOT PROCEED W ITH PREPARATION OF DOORS FOR HARDW ARE UNTIL HARDWARE MOUNTING HEIGHTS AND LOCATIONS HAVE BEEN CONFIRMED BY THE OWNER’S REPRESENTATIVE.

.5 Maintain the numbering and identification system used on the drawings and schedules.

1.5 Special Inspection

.1 Door seam s will be checked by the Owner’s Representative at site on a total of two doors. Remove filler to perm it inspection of welds. Include in contract for making good filler, and application of primer over, at site.

1.6 Method of Measuring Size

.1 Measure width of openings from inside to inside of frame jamb rabbets.

.2 Measure heights of openings from the finished floor (excluding floor coverings) to the head of rabbet of the frame.

.3 Size doors to fit openings and allow a 1.5 mm minim um and 3 mm (1/8") maximum clearance at jams and head of frame. Allow a clearance of 19 mm (3/4") maximum, 6 mm for fire rated doors, between bottom of door and finished floor (inclusive of floor coverings).

Part 2 PRODUCTS

2.1 Door Construction - General

.1 All and only steel doors and frame products manufactured by the Canadian Steel Door and Frame Manufacturer's Association members are eligible for use on this project.

.2 Provide Steel doors and Frames with a combined minimum pre-consumer and post-consumer recycled content of a minimum of 20%.

2.2 Hollow Metal Doors

.1 Standard and fire-rated types with flush faces; of sizes indicated on Drawings and Schedules.

.2 Face material: Commercial grade steel to ASTM A568/A568M, Class 1, hot dipped galvanized to ASTM A653/A653M - commercial quality, coating designation to ASTM A924/924M, ZF075, commercially known as "Colourbond", "Satincoat", or "Galvanneal". For doors in exterior walls and to areas as indicated on the Door Schedule, use coating designation Z275 (fully galvanized).

.3 Primers: rust inhibitive touch up only, as recommended by the door manufacturer.

.4 Filler: metallic paste filler as recommended by the manufacturer.

2.3 Thickness of Materials

Component	Thickness in mm.
Frames	
- Standard Duty	1.6 mm
Doors	
- Honeycomb core construction: Face Sheets	1.2 mm
- Fire rated doors: Face Sheets	1.2 mm
- Exterior doors: Face Sheets	1.6 mm
- Top and bottom Channels	1.2 mm

2.4 Hollow Metal Door Components

.1 Insulated Core Doors: minimum 1.6 mm (16 gauge) thick surface sheets and top and bottom end channels. Cores filled with polyurethane insulation material laminated under pressure to surface sheets.

.2 Honeycomb Core Doors: minimum 1.6 mm (16 gauge) thick surface sheets. Cores filled with honeycomb material laminated under pressure to surface sheets.

.3 Fire Rated Doors: minimum 1.6 mm thick surface sheets. Cores filled with honeycomb material laminated under pressure to surface sheets. Provide labels as indicated.

.4 Cores (Honeycomb): structural small cell (24.5 mm max.) kraft paper "honeycomb". Weight 36.3 kg per ream minimum density, 16.5 kg/m^3 minimum (1.03 pcf), sanded to the required thickness.

.5 Cores (Polyurethane): rigid modified polyisocyanurate, closed cell board, density 32 kg/m^3 minimum, thermal value RSI 1.9 minimum.

.6 Cores (Temperature Rise Rated (TRR)): Core composition to limit temperature rise on the unexposed side of door to 25°C at 30 to 60 minutes, as determined by governing

building code requirements. Test Cores as part of a complete door assembly, in accordance with CAN4-S104, ASTM E2074 or NFPA 252, covering standard methods of tests of door assemblies and listed by a nationally recognized testing agency having a factory inspection service.

.7 Glass Stops: Anemostat “LoPro” or KNC “Steellite” metal vision frame, size to suit glass openings indicated on the drawings. W here applicable, for glazed exterior doors, ensure glass stops will accommodate sealed unit glazing, or use channel as specified for glazing to hollow metal frames, and ensure channel is of sufficient width to accommodate sealed unit glazing.

.8 Provide tight-fitting rigid PVC extruded flush closure caps conforming to C G SB 41-GP-19Ma, at top edge of exterior doors.

.9 Door Reinforcement for Hardware:

- .1 Locks: minimum 1.6 mm (16 gauge) thick steel.
- .2 Butts:
  - .1 Top hinge: minimum 3.5 mm hick steel high frequency hinge bracket as manufactured by Shanahan's or preapproved product.
  - .2 All other hinges: minim um 2.7 mm thick steel, minimum 200 mm long.
- .3 Flush bolts: minimum 1.6 mm thick steel.
- .4 Door closers: minimum 2.5 mm (12 gauge) thick steel.
- .5 Door holders: minimum 2.5 mm thick steel.
- .6 Door pulls: minimum 2.5 mm thick steel.

.10 Adhesives: for honeycomb cores and steel components, use heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement. For polyurethane cores use heat resistant, epoxy resin based, low viscosity contact cement.

2.5 Hollow Metal Doors - Fabrication

.1 Fabricate hollow metal doors in accordance with requirements of "Canadian Manufacturing Standards for Steel Doors and Frames" produced by the Canadian Steel Door and Frame Manufacturers' Association, and as indicated on drawings.

.2 Fabricate fire rated hollow metal doors in accordance with the label authority requirements. Provide ULC or Intertek Testing Services (Warnock Hersey) labels or other testing laboratory approved by the Authority Having Jurisdiction. Place metal labels where visible when installed, riveted to doors.

.3 Test fire labelled doors in strict conformance with CAN4-S104, ASTM E2074 or NFPA 252. Construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.

.4 Fabricate swing type, flush steel doors with provision for glass and/or louvre openings as indicated on the door schedule.

.5 Door thickness: 45 mm unless indicated otherwise.

.6 Fully and continuously weld all seams, and grind smooth.

.7 Shop prime face and backside of all welds.

.8 Ensure spot welding does not leave m arks on exposed faces. Fill spot weld m arks on door faces with filler as specified. Sand smooth, leaving spot weld m arks invisible and producing a uniform surface. Doors with spot weld m arks on exposed faces will be rejected.

.9 Reinforce and prepare doors to receive hardware. Blank, reinforce, drill and tap for mortise, tem plated hardware.

.10 Cut out areas to receive glass as indicated. Reinforce cut-out areas at full perimeter with welded inserts, filled and ground smooth. Install glazing stops in accordance with manufacturers' directions to provide a tamperproof installation. Coordinate glazing with Section 08 80 00.

.11 Factory prepare holes 12.7 mm diameter and larger, except mounting and through-bolt holes, prepared at site at time of hardware installation. Factory prepare holes less than 12.7 mm diameter only when required for function of the device (for knob, lever, cylinder, thumb or turn pieces) or when these holes overlap function holes.

.12 If doors with surface depressions are accepted, fill with metallic paste filler and sand to a smooth uniform finish.

.13 Touch up areas where galvanized coating has been rem oved due to sanding or handling. Use zinc chromate primer CAN/CGSB-1.132.

.14 Install conduit in doors as required for electronic hardware such as electric hinges and strikes. Conduit to be of type and sizes as recommended by the electronic hardware supplier. Coordinate conduit locations with hardware locations.

2.6 Honeycomb and Insulated Core Construction

.1 Form each face of exterior doors from a sheet of 1.6 mm steel with polyurethane core laminated under pressure to face sheets.

.2 Form each face sheet of interior doors from a sheet of 1.6 mm steel with honeycomb core laminated under pressure to face sheets.

.3 Form each face sheet of fire rated doors from a sheet of 1.6 mm steel with honeycomb core laminated under pressure to face sheets. Use temperature rise rated doors where required by Code.

.4 Exterior insulated metal doors to have a maximum overall thermal transmittance of 1.9 $W/(m^2K)$.

2.7 Hollow Metal Door Frames

.1 Type: Standard and fire-rated types with welded corners. Ensure that all sizes shown for fire-rated frames can be labeled.

.2 Size: as shown on Drawings/Schedule. Throat size to suit wall construction for wrap around frames in stud walls.

.3 Material: commercial quality cold rolled sheet steel to ASTM A653/A653M, with zinc coating to ASTM A924/A924M. For interior frames use coating designation ZF075 (wiped coat). For frames in exterior walls and frames to areas as indicated on the door schedule use coating designation Z275 (fully galvanized).

2.8 Frame Components

.1 Frames: minimum 1.6 mm (16 gauge) thick.

.2 Glass Stops: minimum 0.9 mm thick; channel shaped; 16 mm high profile; flush screw applied.

.3 Floor Anchors, channel spreaders and wall anchors. Sheet steel to the following minimum core thicknesses:

.1	Jamb floor anchors	1.6 mm
.2	Jamb spreaders	0.9 mm
.3	Masonry strap type	1.2 mm
.4	Steel Stud type	0.9 mm
.5	Stirrup - strap type wall anchors	1.6 mm
.6	Concrete wall type:	0.9 mm

.7 Wire type anchors **NOT ACCEPTABLE**
Use ULC approved types for labelled frames.

.4 Jamb Anchors: manufacturer's standard type recommended for applicable installation; of suitable design and capable of securely and rigidly anchoring frames in place.

.5 Mortar Guard Boxes: minimum 0.8 mm thick; welded in place.

.6 Reinforcement for Hardware:

.1 Strikes: minimum 1.5 mm thick steel.

.2 Butts:

.1 Top hinge: minimum 3.5 mm thick steel high frequency hinge bracket assembly as manufactured by Shanahan's or preapproved product.

.2 All other hinges: minimum 2.7 mm thick steel, minimum 200 mm long.

.3 Flush bolts: minimum 1.5 mm thick steel.

.4 Door closers: minimum 2.5 mm thick steel.

.5 Door holders: minimum 2.5 mm thick steel.

.7 Door Bumpers: manufacturer's standard resilient single stud rubber/neoprene type; removable for replacement. Mask bumpers for painting.

2.9 Fabrication/Frames

.1 Fabricate hollow metal frames in accordance with requirements of "Canadian Manufacturing Standards for Steel Doors and Frames" produced by the Canadian Steel Door and Frames Manufacturer's Association and as indicated on drawings.

.2 Fabricate fire rated hollow metal door frames in accordance with the label authority requirements. Place metal labels where visible when installed, riveted to frames. Refer to door schedule for fire-rating requirements.

.3 Fabricate all frames of 1.6 mm base thickness steel welded type construction.

.4 Accurately mitre or mechanically joint frames and securely welded on the inside of the profile. Grind welded corners to a flat plane, grind all welds to a smooth, uniform finish. Fill any exposed gaps with metallic paste filler and sand to a smooth uniform finish.

.5 All welding must conform to CSA W 59.

.6 Where applicable, fabricate frames for reverse-acting doors to required profile, as detailed. Reverse the profile at centre of frame head.

.7 Where applicable, provide removable mullions for double doors as indicated on drawings. Reinforce head sections where mullions occur.

.8 Reinforce frames wider than 1200 mm with 2.5 mm thick formed steel channels welded in place, flush with top of frames.

.9 Blank, reinforce, drill and tap for mortised, tem plated hardware.

.10 Protect mortised cutouts with steel guard boxes (omit on drywall applications).

.11 Reinforce and prepare door frames to receive hardware. Provide special box where electric hinge is required. In mortar-filled frames, adhere a piece of spruce wood 12 mm thick to the closer reinforcement to facilitate tapping of screw holes.

.12 Provide for appropriate anchorage to floor and wall construction. Securely attach to jambs. Locate each wall anchor immediately above or below each hinge reinforcement on the hinge jam b and directly opposite on the strike jam b. For rebate opening heights up to 1520 mm provide two (2) anchors and an additional anchor for each additional 760 mm of height or fraction thereof.

.13 Securely attach floor anchors to the inside of each jamb profile.

.14 Provide glazing stops where indicated. Fabricate glazing stops from formed channels, minimum 16 mm high, accurately fitted, butted at corners and fastened to frame sections with counter- sunk oval head sheet metal screws. Drill out screw slots to provide a tam per proof installation. To exterior sidelights, ensure stops are placed to accommodate sealed unit glazing. Coordinate glazing with Section 08 80 00.

.15 Place minimum of 3 bumpers on single door frames and double door frames with removable mullions. Space equally along strike jambs.

.16 Place minimum of 2 bumpers on double door frames. Place on frame heads.

.17 If frames with surface depressions or holes are accepted, fill with metallic paste filler and grind to a smooth finish.

.18 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment while shipping and installing.

.19 Touch up areas where galvanized coating has been rem oved due to sanding or handling, inside and outside of frames, whether exposed or not. Use primer as noted for doors.

2.10 Hollow Metal Screen and Sidelight Frames

.1 Fabricate hollow metal frames for glazed screens and sidelights, to profiles indicated, as for door frames. Provide screwed glass stops. Fabricate to receive dual pane glass where indicated.

.2 Provide structural steel members as required or as indicated within sections, or where multiple sections butt together.

.3 Accurately cope and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 When required due to site access, or due to shipping limitations, fabricate frames for large openings in sections, with splice joints assembled on site.

Part 3 EXECUTION

3.1 Site Storage and Protection

.1 Thoroughly inspect all materials upon receipt and immediately report in writing to the supplier all discrepancies, deficiencies and/or damages.

.2 Note on the carrier's the bill of lading all damage incurred during shipment and report immediately to the supplier in writing.

.3 Properly store materials on planks, out of water and completely covered to protect from damage and weather.

.4 Remove wrappings or coverings from doors upon receipt at site. Properly store doors in vertical position spaced by blocking to permit air circulation.

.5 Store frames vertically in a dry location, off ground and prevent damage and weathering.

3.2 Installation/Frames

.1 Set frames as indicated, rigid, plumb, square, true to line and level and at proper elevation and place without distortion.

.2 In concrete walls, limit of acceptable frame distortion 1.5 mm of plumb measured on face of frame. Maximum twist corner to corner 3.0 mm.

.3 In drywall and steel stud partitions, limit of distortion to be 1.6 mm out of plumb each jamb, measured on face of frame resulting in maximum twist of frame of 2 mm measured from upper corner to lower diagonal corner.

.4 Install fire labeled frames in accordance with NFPA-80, most current edition.

.5 Install a temporary horizontal spreader at mid-height of door opening to maintain frame width until building in work is completed. Remove mid-height and bottom temporary spreader only after completion of adjacent work. Grind frame smooth where metal spreader was removed.

.6 Locate and anchor frames in alignment with other work.

.7 Install anchors at 750 mm o.c. maximum in walls, unless noted otherwise.

.8 Securely anchor frames to retain position and clearance during construction of walls or partitions.

.9 Fill interior frames in steel stud partitions, with mineral wool insulation,

.10 Install pressure grout fill to interior frames in concrete walls.

.11 Fill exterior frames with foam-in-place insulation as specified in Section 07 21 19.

.12 Coordinate with installation of air/vapour barrier specified in Section 07 27 13.

.13 Provide support at centre for head to frames over 1200 mm wide.

.14 Make allowance for deflection to ensure structural loads are not transmitted to frames.

.15 Where field jointing, use countersunk metal screws. Joints to be filled and ground smooth.

.16 Drill and tap for surface applied hardware.

.17 Remove all hardware before painting commences and replace upon completion of painting or original condition without damage to adjacent finished surfaces.

3.3 Installation/Doors

.1 Install doors and hardware in accordance with templates and hardware manufacturer's instructions. Install square into openings, with correct edge spaces. Refer to Section 08 71 00 for hardware installation requirements.

.2 For fire rated doors, provide even margins between doors and jambs and doors and flooring and thresholds as follows:

.1 Hinge side: minimum 1.5 mm, maximum 3 mm.

.2 Latch side and head: minimum 1.5 mm, maximum 3 mm.

.3 Flooring: maximum 19 mm.

.3 Adjust operable parts for correct function.

.4 Where indicated, install louvres in accordance with louvre manufacturer's directions.

3.4 Adjust and Clean

.1 Remove rust, sand abrasive areas and supply touch-up factory primer prior to application of field applied finish coat.

.2 Clean all door frames after installation, removing all foreign matter.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Supply and installation of floor hatches for wet well pump and personnel access.

1.3 Reference Standards

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM A36-93a: Specification for Structural Steel.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB 1.105 M91, Quick Drying Primer.

.3 Environmental Choice Program (ECP).

.1 CCD 045 92, Sealants and Caulking Compounds.

.2 CCD-047a 98, Surface Coatings.

.3 CCD 048 95, Recycled Water borne Surface Coatings.

1.4 Submittals

.1 Product data: Submit manufacturer's printed product literature, specifications, and data sheet in accordance with Section 01 33 00 - Submittals.

.2 Submit two copies of WHMIS MSDS Material Safety Data Sheets in accordance with Section 01 33 00 Submittals. Indicate VOC's for caulking materials during application and curing.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 Submittals.

.2 Indicate size and description of components, materials, attachment devices, description of frame and finish, and construction details.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Shall be stamped by a Professional Engineer registered in the province of Alberta

1.5 Closeout Submittals

.1 Provide maintenance data for hardware complete with pertinent details, spare parts lists and warnings against harmful maintenance materials and practices for incorporation into manual specified in 01 78 23 – Operation and Maintenance Data.

1.6 Warranty

.1 Manufacturer’s standard warranty: Materials shall be free of defects in material and workmanship for a period of (5) five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no

charge. Special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

Part 2 PRODUCTS

2.1 Manufacturer

.1 Not used.

2.2 Access Hatches

.1 Basis of Design: Gas Tight Stainless Steel Hatch

.2 Furnish and install where indicated on plans vault access door type, sizes as indicated on Drawing. Length denotes hinge side. The vault access door shall be single leaf. The vault access door shall be pre-assembled from the manufacturer.

.3 Performance characteristics:

.1 Cover: reinforced to support a minimum live load of 14.4 kPa with a maximum deflection of 1/150th of the span.

.2 Smooth and easy operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing. Operation of the cover shall not be affected by temperature.

.4 Cover: Checkered Tread Plate to Type 316 Stainless Steel with a minimum thickness of 6.35mm.

.5 Frame: Structural Shapes to Type 316 Stainless Steel framed with a flush angle frame with perimeter cast anchors, D profile neoprene sealing gasket.

.6 Hinges: designed for horizontal and welded to cover. Type 316 Stainless Steel.

.7 Lifting mechanisms: Cam-action hinges shall pivot on torsion bars to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing.

.8 Provide Safety access grates under all hatch covers. Ensure all access grates are:

.1 Hinged,

.2 Equipped with a retractable lifting handle,

.3 Rated to withstand a live load of 14.4 kPa,

.4 Highly visible; either safety orange or red if fibreglass; aluminum grating to be powder coated, applied by electrostatic spray process; coating is a thermosetting epoxy powder coat finish minimum 2mm thick and baked at 180 ºC until cured.

.5 Equipped with lock mechanism which holds the grate at 90 degrees vertical.

.9 Removable exterior turn/lift handle with a spring loaded ball detent, to open cover.

.10 Hardware:

.1 Hinges: Type 316 steel cam-action hinges which pivot on torsion bars shall be provided.

.2 Cover equipped with a steel hold open arm that automatically locks cover in the open position.

.3 Cover fitted with the required number and size of torsion bars.

.4 Type 316 stainless steel snap lock with fixed handle shall be mounted on underside of cover.

.5 Type 316 stainless steel hasp and lock.

.11 Finishes: Factory finish, mill finish Stainless steel.

.12 Sealants: as indicated in Section 07 92 00.

.1 Test for acceptable VOC emissions in accordance with ASTM D2369 and ASTM D2832

.2 Acceptable materials: CCD-045.

.13 Isolation coating: alkali resistant bituminous paint or epoxy solution.

Part 3 Execution

3.1 Manufacturer’s Instructions

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 Installation

.1 Furnish mechanical fasteners consistent with the vault access door manufacturer’s instructions.

.2 Erect components plumb, level and in proper alignment.

.3 Adjust and seal assembly with provision for expansion and contraction of components.

.4 Paint all surfaces coming in contact with concrete or dissimilar metals with one thick coat of bituminous paint.

3.3 Cleaning

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of the Contract and all Sections of Divisions 00 and 01, shall form an integral part of the requirements of this Section.

.2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.

.3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other Sections.

1.2 Section Includes

.1 Door hardware, as follows:

.1 Door hardware: hinges, locks, handles, closers, door stops, kickplates, push plates, and panic hardware, and electronic access systems.

.2 Weatherstripping.

.3 Thresholds.

.4 Closers with smoke detector and hold-open/release device.

.5 Door security accessories.

1.3 Quality Control

.1 Do not combine supplier bids for door hardware with bids for doors and frames.

.2 Supplier: A recognized builders Hardware Supplier who has been furnishing hardware in the project’s vicinity for a period of not less than five (5) years, and who is or has in employment an Architectural Hardware Owner’s Representative (AHC) who holds a current certification seal of the Door and Hardware Institute. All documents submitted shall bear the seal of the hardware Owner’s Representative. The hardware Owner’s Representative shall be available for on site consultation as required. The supplier shall have adequate equipment, maintenance and advisory facilities in order to serve and keep pace with contract obligations and responsibilities.

1.4 References

.1 All Standards listed below are to be the most current edition at the time of tender regardless of any older dates that may be listed herein unless specifically noted otherwise. Withdrawn or obsolete standards may still apply unless it has been replaced with a different Standard in which case the new Standard shall apply. Report any withdrawn Standards to the Owner’s Representative for instructions.

.2 ANSI/BHMA A156.1 - 2013: Butts and Hinges.

.3 ANSI/BHMA A156.2 - 2011: Bored and Preassembled Latches.

.4 ANSI/BHMA A156.3 - 2014: Exit Devices.

.5 ANSI/BHMA A156.4 - 2013: Door Controls - Closers.

.6 ANSI/BHMA A156.5 - 2014: Auxiliary Locks and Associated Product.

.7 ANSI/BHMA A156.6 - 2010: Architectural Door Trim.

.8 ANSI/BHMA A156.7 - 2015: Template Hinge Dimensions.

.9 ANSI/BHMA A156.8 - 2010: Door controls - Overhead Stops and Holders.

.10 ANSI/BHMA A156.9 - 2010: Cabinet Hardware.

.11 ANSI/BHMA A156.10 - 2011: Power-Operated Pedestrian Doors.

.12 ANSI/BHMA A156.11 - 2014: Cabinet Locks.

.13 ANSI/BHMA A156.12 - 2013: Interconnected Locks and Latches.

.14 ANSI/BHMA A156.13 - 2012: Mortise Locks and Latches.

.15 ANSI/BHMA A156.14 - 2013: Sliding and Folding Door Hardware.

.16 ANSI/BHMA A156.15 - 2011: Release Devices - Closer Holder, Electromagnetic and Electromechanical.

.17 ANSI/BHMA A156.16 - 2013: Auxiliary Hardware.

.18 ANSI/BHMA A156.17 - 2014: Self Closing Hinges and Pivots.

.19 ANSI/BHMA A156.18 - 2012: Materials and Finishes.

.20 ANSI/BHMA A156.19 - 2013: Power Assist and Low Energy Operated Doors.

.21 ANSI/BHMA A156.20 - 2012: Strap and Tee Hinges and Hasps.

.22 ANSI/BHMA A156.21 - 2014: Thresholds.

.23 ANSI/BHMA A156.22 - 2012:: Door Gasketing and Edge Seal Systems.

.24 ANSI/BMHA A156.23 - 2010: Electromagnetic Locks.

.25 ANSI/BHMA A156.24 - 2012: Delay Egress Locks.

.26 ANSI/BHMA A156.25 - 2013: Electrified Locking Devices.

.27 ANSI/BHMA A156.26 - 2012: Continuous Hinges.

.28 ANSI/BHMA A156.28 - 2013: Recommended Practices for Keying Systems.

.29 ANSI/BHMA A156.29 - 2012: Exit Lock and Alarms

.30 ANSI/BHMA A156.30 - 2014: American National Standard for High Security Cylinders

.31 ANSI/BHMA A156.31 - 2013: Electric Strikes and Frame Mounted Actuators

.32 NFPA (Fire) 80: Standard for Fire Doors and Other Opening Protectives, 2013 Edition

.33 NFPA (Fire) 101: Life Safety Code, 2015 Edition.

.34 NFPA (Fire) 105: Standard for Smoke Door Assemblies and Other Opening Protectives, 2013 Edition

.35 NFPA (Fire) 252: Fire Tests of Door Assemblies, 2012 Edition

.36 ULC ORD-C14(e) -M1985: Guide for Hardware for Fire Doors and Emergency Exits

.37 ULC ORD-C228 -1995: Door Closers and Holders

.38 ULC C305 -M1972: Panic Hardware

.39 CAN/ULC S104 -10: Standard Method for Fire Tests of Door Assemblies

.40 CAN/ULC S132 -07: Standard For Emergency Exit And Emergency Fire Exit Hardware

.41 CAN/ULC S133 -07: Standard for Door Closers Intended for Use with Swinging Doors

.42 CAN/ULC S529 -09: Smoke Detectors for Fire Alarm Systems

.43 CAN/ULC S533 -08: Egress Door Securing And Releasing Devices

.44 DHI - Recommended Locations for Architectural Hardware - Standard Steel Doors & Frames (2004).

.45 DHI - Recommended Locations for Architectural Hardware for Flush W ood Doors (1993).

.46 Door & Hardware Institute Sequence Format for Hardware Schedule - (latest edition).

.47 If requested by the Owner’s Representative provide a PDF digital copy of any or all of the Standards above as selected by the Owner’s Representative at no additional cost.

1.5 Submittals

.1 Submit hardware schedule in accordance with Division 1, in vertical format prepared in accordance with Door & Hardware Institute Sequence and form at recommendations.

.2 Coordinate reviewed shop drawings from affected trades, as soon as possible after award of hardware contract.

.3 Submit template information to all manufacturers who have door hardware applied to their products.

.4 Prepare and submit a complete detailed hardware schedule. Provide five copies. Incorporate addenda items and any Owner’s Representative accepted changes into detailed hardware list.

.5 On doors of different sizes or where hinges, closers, or locks are different, use a separate heading. Do not combine labelled openings with non-labelled openings.

.6 Clearly indicate hardware proposed, including make, model, material, function, finish, quantities and location in project, and all other pertinent information.

.7 Provide manufacturer's printed literature for each piece of hardware listed in the hardware schedule, with technical information and a picture of each item.

.8 If requested, supply a sample of each hardware item as required, to be retained by Owner’s Representative for comparison with hardware furnished. Replace any deviation from hardware schedule with scheduled hardware. The Owner’s Representative will deliver the accepted samples to the project site to be stored. Samples will remain there until delivery of hardware to the project site is complete, when they will be incorporated in the work.

.9 Mark samples plainly giving hardware number used in the hardware list, the manufacturer's name, numbers, types and sizes.

.10 Furnish confirmation of hardware compliance to ANSI/NFPA80, ANSI/NFPA101 and the Alberta Building Code by the supplier prior to installation.

.11 Furnish three (3) copies of a keying schedule and bitting list in accordance with Part 2 of this Section.

.12 After installation, turn over to the Owner, one (1) copy of representative templates, instruction sheets, hardware schedule, and keying schedule for permanent record.

.13 Submit shop drawings of each type of door indicating mounting heights and locations of each piece of hardware. DO NOT PREPARE DOORS TO RECEIVE HARDWARE UNTIL MOUNTING HEIGHTS AND HARDWARE LOCATIONS HAVE BEEN CONFIRMED BY THE OWNER’S REPRESENTATIVE.

1.6 Delivery

.1 Co-ordinate the delivery of hardware to avoid any delay in the work.

.2 Deliver and store hardware material in original undamaged containers with manufacturer's labels and seals intact, except permanent cylinder and keys.

.3 Neatly package hardware items in substantial and secure boxes, properly labelled and readily identifiable for individual locations and use.

.4 Include all items of securement and fastening, such as screws, bolts, nuts, brackets, and the like. Use Phillips head type screws except where specifically required otherwise.

.5 Protect knobs, handles, push plates and pulls with adhesive release paper of type easily removable without marring finish. Do not remove protective coating until completion of project.

.6 Mark cylinders for all locks with specific door number as per door schedule.

.7 Packaging to include the following with each item of hardware:

.1 Screws, bolts and fastenings necessary for installation.

.2 Installation instructions.

.3 Special tools required for installation.

.4 Keying for locksets tagged and plainly marked with change number, door designation and all other identifying information as required, mounted on key board.

1.7 Storage

.1 Provide one specific room for storing hardware as received. Provide the room with adequate security.

.2 Store in a clean dry room with lockable man door and adequate shelving to permit organization so item numbers are readily visible. Ambient room temperature shall be between 0°C and 50°C.

1.8 Coordination

.1 Before furnishing any hardware, check all drawings and specifications for hardware requirements, verifying door swings, check all shop drawings with frame and door lists and advise Owner’s Representative in writing of discrepancies noted.

.2 Deliver templates required for shop fabrication to fabricator of hollow metal doors and frames and aluminum frames in ample time so as not to impede the progress of the work.

.3 Ensure early delivery of all hardware required.

1.9 Maintenance

.1 Provide the following for the Owner's maintenance staff:

.1 One set wrenches for door closers and locksets. The hardware installer must turn over all wrenches and installation instructions to the Construction Manager, who, in turn will turn such wrenches and instructions to the Owner upon completion.

.2 Manufacturer's installation instructions for door closers and locksets.

.3 Manufacturer's instructions in regard to proper care of hardware including lubrication of locksets.

.2 Brief the building maintenance staff regarding the proper care of hardware such as lubrication of locksets, adjustments of door closers, cleaning and general maintenance.

.3 Provide maintenance data for each piece of hardware, for incorporation into the maintenance manuals specified in Division 1.

1.10 Warranty

.1 Provide a ten (10) year warranty period for door closers and a three (3) year warranty period for panic devices. Provide copies of manufacturer's warranties for door closers and panic devices.

Part 2 PRODUCTS

2.1 Materials

.1 Provide Door Hardware with a combined minimum pre-consumer and post-consumer recycled content of 10%.

.2 Provide materials and finishes as specified in the Hardware Schedule or equals from the following Acceptable Manufacturer List. Other alternatives will not be accepted:

.1 Hinges: Stanley, Hager, McKinney, Dorma, Ives

.2 Locks: Schlage

.3 Closers: LCN

.4 Exit Devices: Von Duprin

.5 Flatware: Standard Metal, Gallery, Ives, CBH, CDH

.3 Supply all products in a given category, from the same manufacturer.

2.2 Keying and Keys

.1 Construction keying:

.1 Furnish a construction masterkey system with 15 keys for locks and cylinders.

.2 Use only the construction keys during construction.

.3 Upon Substantial Performance of the W ork, void the construction key system and, in the presence of the Owner's Representative, demonstrate that the specified keying system is operating properly.

.2 Furnish all locksets with three (3) cut keys. Factory masterkey and construction masterkey all cylinders. Furnish twelve (12) masterkeys for each group and three (3) grand master keys.

.3 Consult with the Owner's Representative and Owner and secure written acceptance of complete keying layout prior to placing lock order.

.4 Stamp all keys "DO NOT COPY".

.5 Identify permanent keys with tags.

2.3 Labelled Hardware

.1 Provide labelled hardware of equal rating to doors requiring ULC or UL label.

2.4 Materials and Finishes

.1 Provide materials and finishes as listed in hardware schedule. Alternatives will not be accepted.

2.5 Fasteners

.1 W here pull scheduled on one side of door and push plate on opposite side, supply fastening devices and stall so pull can be secured through door from reverse side.

.2 Provide ferrous or non-ferrous fasteners matching the product being supplied.

2.6 Packaging, Templates and Quantities

.1 Package hardware with all necessary screws and fittings, and clearly label as to intended location and use.

.2 Furnish templates and all necessary information for the proper installation of the hardware to metal doors and frames.

2.7 General Notes

.1 Co-ordinate electric hold-open closers with Electrical Contractor.

.2 Where butt hinges are required to swing 180 degrees, furnish butts of sufficient throw to clear trim as required.

.3 Where applicable, Provide keyed "Removable Mullion" on pairs of doors requiring panic hardware where a fixed mullion cannot be used to allow for deliveries.

.4 Provide nickel-silver keys.

Part 3 EXECUTION

3.1 Inspection

.1 Verify that frames have been installed plumb and within tolerances as set out in DHI Document "Installation of Commercial Steel Doors and Steel Frames".

.2 Verify that wiring conduit boxes for any electrical hardware are provided to receive hardware.

.3 Prior to installation, ensure that doors and frames are properly prepared and reinforced to received finish hardware.

.4 Ensure that door frames and finished floor are sufficiently plumb, and level to permit proper engagement and operation of hardware.

3.2 Installation

.1 Generally, install hardware at mounting heights in Recommended Locations for Architectural Hardware - Standard Steel Doors.

.2 Install, fit, adjust, and clean hardware to manufacturer's directions. Install and adjust hardware to operate freely. Protect from damage.

.3 Install hardware using carpenters skilled in the application of commercial grade hardware.

.4 Co-ordinate requirements for power and alarm wiring to hold open/release devices with the electrical trade contractor.

.5 Install hardware to degree of opening as listed in the hardware schedule.

3.3 Inspection of Installation

.1 After installation, have the hardware supplier inspect the hardware and certify in writing to the Contractor (copy to the Owner’s Representative) whether or not all hardware items are in accordance with specification requirements and are installed and functioning properly.

3.4 Adjusting and Cleaning

.1 Prior to final inspection, make final adjustment to hardware items and ensure correct operation. Replace any hardware that is scratched, marked or damaged. Clean and polish all hardware.

END OF SECTION

DIVISION 09

FINISHES

Part 1 GENERAL

1.1 Scope

.1 Prepare surfaces which are to receive finish.

.2 Finish surface as indicated in the finish schedule at the end of this Section.

1.2 Quality Assurance

.1 Acceptable manufacturers, materials, workmanship and all items affecting the work of this Section is to be in accordance with Canadian Painting Contractors Association (CPCA) "Architectural Painting Specification Manual".

1.3 Colour Schedule

.1 Submit colour sheet from chosen supplier. Owner's Representative will select colour schedule from chart.

.2 If requested by the Engineer provide for approval a 215 x 279 mm sample of each colour on the actual base material.

1.4 Delivery

.1 Deliver paint materials in sealed original labelled containers, bearing manufacturer's name, type of paint, brand name, colour designation and instructions for mixing and/or reducing.

1.5 Storage

.1 Provide adequate storage facilities. Store paint materials at a minimum ambient temperature of 7°C and in a well-ventilated area.

.2 Take all precautionary measures to prevent fire hazards and spontaneous combustion.

1.6 Environmental Conditions

.1 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless the moisture content of surfaces is below the following maximum:

.1 Masonry, concrete, and concrete block: 12%

.2 Interior located wood: 15%

.3 Exterior located wood: 18%

.4 Plaster and gypsum board: 12%

.2 Ensure surface temperatures or surrounding air temperature is above 5°C before applying finishes. Minimum application temperatures for latex paints is 7°C for interior works and 10°C for exterior work.

.3 Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 7°C for 24 hours before, during and 48 hours after application of finishes.

.4 Provide minimum 400 lux of lighting on surfaces to be finished.

1.7 Protection

.1 Adequately protect other surfaces from paint and damage. Make good any damage as a result of inadequate or unsuitable protection.

.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation areas.

.3 Place waste cloths and material which may constitute a fire hazard in closed metal containers and remove daily from site.

.4 Remove all electrical plates, surface hardware, fittings, and fastenings prior to painting operations. Carefully store, clean, and replace these items on completion of work in each area. Do not use solvent that may remove the permanent lacquer finish on hardware.

Part 2 PRODUCTS

2.1 Materials

.1 Paint, varnish, stain, enamel, lacquer, and fillers: of type and brand listed under "Paint Product Recommendations" indicated in the CPCA Specification Manual. Brands manufactured by Bapco, Benjamin-Moore, Canadian Pittsburgh, C.I.L., Cloverdale, Glidden, General Paint, International Paint, Mobil Chemical, Northern Paint, Sherwin-Williams, or other approved manufacturers are acceptable.

.2 Accessory materials such as linseed oil, shellac, turpentine, and other materials required to achieve the finishes specified shall be of high quality and approved manufacturer.

.3 Paints shall be ready-mixed unless otherwise specified, except that any coating in paste or powder form, or to field-catalysed shall be field-mixed in accordance with the directions of its manufacturer. Pigments shall be fully ground and shall maintain a soft paste consistency during storage and shall be dispersed readily and uniformly by paddle to a complete homogeneous mixture.

.4 The paint shall have good flowing and brushing properties and shall dry or cure free of streaks or sags.

Part 3 EXECUTION

3.1 Conditions of Surfaces

.1 Thoroughly examine all surfaces scheduled to be painted prior to commencement of work. Report in writing to the Engineer any condition that may potentially affect proper application.

.2 Be responsible for the condition of surfaces and for correcting defects and deficiencies in the surfaces which may adversely affect work of this section. Do not commence until all defects have been corrected.

.3 Obtain necessary information from other trades on compatibility of their primers and finishes with work of this section.

3.2 Preparation of Surfaces

.1 Refer to the CPCA Manual for preparations of the various surfaces and materials to receive paint finishes.

.2 Remove mildew, by scrubbing with a solution of TSP and bleach. Rinse with clean water and allow surface to dry completely.

.3 Remove surface contamination and oils from zinc coated surfaces and prepare for priming in accordance with metal manufacturer's recommendations.

.4 Remove grease, rust, scale, dirt and dust from steel and iron surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure all steel surfaces are satisfactory before paint finishing.

.5 Clean unprimed steel surfaces by washing with a solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are cleaned. Prime surfaces to indicate defects.

.6 Remove surface contamination from aluminium, galvanized, and copper surfaces requiring a paint finish by steam, high pressure water or solvent washing. Apply etching primer or acid etch. Apply paint immediately if acid etching.

.7 Remove contamination, acid etch and rinse new concrete with clear water. Ensure a required acid-alkali balance is achieved. Allow to thoroughly dry. New concrete shall be cured for a minimum of 60 days prior to coating application.

.8 Remove contamination from gypsum wallboard surfaces and prime to show defects. Carry on with paint coating after defects have been remedied.

.9 Remove dirt, loose mortar, scale, powder and other foreign matter from concrete block surfaces which are to be painted or to receive a clear seal. Remove oil and grease with a solution of TSP, rinse well and allow to throughout dry.

.10 Remove stains from concrete and concrete block surfaces caused by weathering or corroding metals with a solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.

.11 Sand and scrape shop primed steel surfaces to remove all loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean all surfaces with solvent. Prime bare steel surfaces.

.12 Wipe all dust and grit from all miscellaneous wood items and millwork prior to priming. Spot coat knots, pitch streaks and sappy sections with sealer. Fill all nail holes and cracks after primer has dried and sand between coats.

3.3 Installation/Application

.1 Apply paint and other finishes in accordance with good trade practice.

.2 Finishes specified are intended to cover surfaces satisfactorily when applied in accordance with manufacturer's recommendations.

.3 Apply each coat at the proper consistency.

.4 Sand and dust between each coat to remove defects visible from distance up to 1.5 m.

.5 Do not apply finishes on surfaces that are not sufficiently dry.

.6 Allow each coat of finish to dry before a following coat is applied, unless directed otherwise by manufacturer.

.7 Where clear finishes are required, ensure tinted fillers match wood. Work fillers well into the grain before it has set. Wipe excess from the surface.

.8 Backprime exterior woodwork, which is to receive a paint finish, with exterior primer paint.

.9 Backprime interior woodwork, which is to receive a paint finish, with enamel undercoater paint.

.10 Backprime woodwork which is to receive a stain and/or varnish finish with a gloss varnish reduced 25 percent with mineral spirits.

.11 Prime top and bottom edges of wood and metal doors with enamel undercoater when they are to be painted.

.12 Prime top and bottom edges of wood doors with gloss varnish when they are to receive a stain or clear finish.

3.4 Mechanical and Electrical Equipment

.1 Colour code equipment, piping, conduit and exposed ductwork in accordance with the following definitions:

.1 Pipes are defined as conduits for the transport of gases, liquids, semi-liquids, or plastics.

.2 Piping systems shall include pipes of any kind, fittings, valves, and pipe coverings. Supports, brackets or other accessories are specifically excluded.

.3 Hazardous materials are materials which are flammable, explosive, corrosive, chemically active, toxic, productive of poisonous gases, or at high temperatures or pressures.

.4 Fire quenching materials include CO2 chemical foam, sprinkler system, and all other fire fighting and related equipment.

.5 Safe materials shall include all materials that hold little or no hazard to personnel or property.

.6 Protective materials shall include all materials used to prevent or minimize the hazards of dangerous materials but excluding fire quenching materials.

.2 Identification

.1 All exposed piping systems shall be identified by colour and by legend.

.2 Piping identification shall be positioned every 3 metres on straight runs of pipe, at changes of direction, and on both sides of equipment, valves, junctions, walls, floors, or ceilings.

.3 The legend shall consist of stencilled letters or approved proprietary marking system giving the name of the contents in full or in abbreviated form. Temperature, pressure, an arrow indicating direction of flow, and similar information should be included when pertinent. The legend letters shall be positioned upright and normal to the operators viewing point whenever possible. Letters shall be of an approved, easily readable style.

.4 The size of legend letters and colour bands shall be as outlined in Table 1 below or as directed by the Engineer.

TABLE 1: SIZE OF LEGEND LETTERS

Outside Diameter of Pipe or Covering (mm)	Length of Colour Field (mm)	Size of Letters (mm)
19 to 32	200	13
38 to 51	200	19
64 to 190	300	32
200 to 250	600	64
over 250	800	89

.5 The colours for identification of piping systems in water and wastewater facilities shall be as recommended in the Alberta Environment publication" Standards and Guidelines for Municipal Water Supply, Wastewater, and Storm Drainage Facilities".

.3 Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.

.4 Finish paint primed equipment and all exposed ducts.

.5 Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars and supports, except where items are plated or covered with a pre-finished cladding.

.6 Replace identification markings on mechanical or electrical equipment when painted over or spattered.

.7 Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvres with one coat of flat black paint, to limit of sightline.

Paint dampers exposed immediately behind louvres, grilles, convector and baseboard cabinets to match face panels.

.8 Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

3.5 Finishes

.1 The CPCA finishes noted below are detailed in the CPCA Manual in Chapter 4B, Interior Painting and Finishing, and Chapter 4A, Exterior Painting and Finishing.

.1 Interior

Surface		CPCA Finish
.1	Wood, Painted	- alkyd wood primer - enamel undercoat, tinted - alkyd enamel, semi-gloss
.2	Wood, Stained	- wood stain - sanding sealer - alkyd varnish, gloss - alkyd varnish, semi-gloss
.3	Wood, Natural Finish	- urethane, gloss cut 25% - urethane, gloss - urethane, semi-gloss
.4	Ferrous Metals, primed painted	- alkyd metal primer - alkyd enamel, gloss - interior alkyd, semi-gloss
.5	Concrete block and concrete, painted, filled	- latex block filler - enamel undercoat - alkyd enamel, semi-gloss
.6	Cedar, stain wax finish	- stain wax, clear - stain wax, clear - buff with clean lint-free cloth
.7	Drywall, painted	- latex sealer - enamel undercoat - alkyd enamel, low lustre

.2 Exterior

.1	Ferrous metals, galvanized, painted	- galvanized iron primer - exterior alkyd gloss - exterior alkyd gloss
.2	Ferrous metals, primed, painted	- zinc chromate primer - alkyd gloss enamel - alkyd gloss enamel
.3	Concrete block (filled) painted	- block filler for block and exterior - latex for concrete - exterior latex - exterior latex

.4	Wood, painted	- exterior alkyd primer - exterior alkyd gloss - exterior alkyd gloss
.5	Concrete, painted	- exterior latex - exterior latex
.6	Cedar surfaces	- exterior wood stain - exterior wood stain

.7 Note: Wolmanized Cedar surfaces require no further finishing

3.6 Cleaning

.1 As the work proceeds and upon completion, promptly remove all paint where spilled, splashed or spattered.

.2 During the progress of work keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Upon completion of work leave premises neat and clean, to the satisfaction of the Engineer.

END OF SECTION

DIVISION 11

EQUIPMENT

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Section Includes

.1 Supply and install personnel rescue davit sockets/bases and supply personnel rescue davit lifting arms.

.2 Coordinate with the work of other sections.

1.3 Reference Standards

.1 CSA Z259.16-15 (R2020) Design of Active Fall Protection Systems

.2 ANSI/ASSE Z359 Fall Protection Code.

.3 Alberta Occupational Health and Safety Act, Regulation and Code.

1.4 Submittals

.1 Product data: Submit manufacturer's printed product literature, specifications, and data sheet in accordance with Section 01 33 00 - Submittals.

.2 Submit shop drawings in accordance with Section 01 33 00 including the following:

- .1 Required information to be compliant with CSA Z259.16
- .2 Stamped and signed by a professional engineer registered or licensed in Alberta
- .3 Indicate component profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- .4 Dimensions, weights, and clearances.
- .5 Section drawings showing all components and materials of construction.

.3 Submit operation and maintenance data in accordance with Section 01 77 00 including:

- .1 Manufacturer’s installation, operation, and maintenance instructions for all equipment.
- .2 Local supplier and service depot, name, address, phone number, and contact person.
- .3 Model numbers, names, types, dates of manufacture and serial numbers.
- .4 Recommended spare parts list.

.4 Provide all required written certifications from the manufacturer showing that the equipment is in compliance with all applicable codes and standards.

.5 After erection, provide an inspection and test report in accordance with CSA Z259.16 requirements from the manufacturer’s service representative indicating that all fall protection equipment is operating properly.

Part 2 PRODUCTS

2.1 Manufacturer

.1 3M Canada DBI-Sala.

.2 Substitutions will not be considered.

2.2 Fall Arrest Components

.1 Davit Arm Bases: 3M DBI-SALA Advanced Center Mount Sleeve Davit Base, 8516563, silver, stainless steel

.2 Travel Restraint Anchors: 3M DBI-SALA Concrete Detent Anchor, 2101004C, silver, stainless steel

Part 3 Execution

3.1 Manufacturer’s Instructions

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 Installation

.1 Install in accordance with manufacturer’s recommendations.

.2 Test equipment including operating through complete lifting and lowering cycle, and supply a written report certifying that the installations meets all requirements.

.3 If the equipment is used by the Contractor, it shall be restored to new condition prior to acceptance.

3.3 Cleaning

.1 Upon completion of installation, remove surplus materials, rubbish, tools, and equipment barriers.

END OF SECTION

DIVISION 22

PLUMBING

1 General

1.1 INTENT

.1 This specification includes general requirements applicable to the supply, installation and testing of the complete plumbing systems.

.2 This Section includes the following:
- .1 General Plumbing Requirements specifically applicable to all Division 22 Sections.
- .2 Grout.
- .3 Plumbing Demolition (when indicated on the drawings).
- .4 Equipment installation requirements common to equipment sections.

1.2 CONDITIONS AND DEFINITIONS

.1 The terms Manufacturer and Supplier are interchangeable and have the same meaning with respect to the interpretation of this Section.

1.3 REGULATORY REQUIREMENTS

.1 Contractor is responsible to comply with all the latest versions of Regulatory Requirements and Codes whether specifically mentioned in the Contract Documents or not.

.2 Refer to the Natural Gas and Propane Installation Code

.3 Refer to the National Plumbing Code of Canada

1.4 SUBMITTALS

.1 Provide
- .1 Current ANSI / NSF 60 & 61 certification for products used in contact with potable water.

.2 Contractor to submit individual submittals for each product or piece of equipment.

.3 “Bulk” submittals will be returned, “Not Reviewed”.

.4 Refer to individual plumbing specifications for additional submittal requirements.

1.5 CONTRACTOR RESPONSIBILITIES

.1 The Contractor shall provide all tools, equipment, materials, and supplies necessary and shall provide all labor necessary to complete the Work specified herein and within the Contract Document to provide a complete and functional system.

.2 Contractor to coordinate installation of natural gas service with the gas utility.

.3 Coordinate installation of electrical and control requirements with the electrical contractor.

.4 Connection of all electrical devices to be done by the electrical contractor.

.5 Provide all piping, valves, fixtures and equipment shown on drawings and specified herein complete with supports,.

.6 Submit shop drawings for all products and pieces of equipment.

.7 Provide start-up and commissioning of all systems.

.8 Provide operations and maintenance data.

1.6 EXAMINATION

.1 The Contractor shall review the Contract Documents and obtain additional dimensions and details from the Place of Work. Accurate dimensions shall be verified by actual measurements by the Contractor.

.2 Should the Contractor wish to change the location of equipment or pipework, they shall submit a request to the Owner's Representative for acceptance. If accepted, such changes shall be made at no additional cost to the Owner or the Owner's Representative.

.3 No additional costs will be permitted for any additional labor or materials required for relocation of equipment due to interference with equipment of other trades, beams, joists, walls, etc., unless the conflict has been submitted and identified to the Owner's Representative in writing before closing of tenders.

1.7 NOTICES, PERMITS, AND CERTIFICATES

.1 Refer to Front End documents for additional information.

.2 The Contractor is responsible to obtain and pay for all permits required to complete the Work from the local authority having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

.2 Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

2 Products

2.1 EQUIPMENT REQUIREMENTS

.1 All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.

.2 Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.

.3 Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.

.4 All equipment shall be designed for continuous operation unless stated otherwise. All mechanical rotating parts shall be dynamically balanced for smooth operation. Limit vibration velocity at equipment bearings to 1 mm/s unless stated otherwise.

.5 All equipment shall be designed to achieve a noise level not exceeding 85 dB (A) measured at 1.5 m from the equipment, unless a more stringent level is stated elsewhere within the Contract Documents.

.6 Permit equipment maintenance and disassembly by use of approved couplings, unions or flanges to minimize disturbance to connecting piping and without interference from the building structure or other equipment.

.7 Provide accessible means to lubricate equipment.

.8 Provide accessible means to replace “lubricated lifetime bearings”.

.9 Design equipment housekeeping pads to eliminate resonance and to absorb vibration from the equipment. Mount equipment on chamfered edge concrete pads at a minimum of 100 mm high and 100 mm larger than equipment dimensions all around, unless stated otherwise within the Contract Documents.

.10 Pipe all drain lines to sump or floor drains unless stated otherwise within the Contract Documents.

2.2 ELECTRIC MOTORS AND EQUIPMENT

.1 Electrical work must conform to the Contract Documents.

.2 All motors and electrical equipment must be provided in accordance with the Contract Documents

.3 All motors and electrical equipment must be certified to CSA, IEEE, NEMA and EEMAC standards, where applicable to the equipment provided.

2.3 IDENTIFICATION

.1 Manufacturer's nameplates:
- .1 Provide corrosion resistant metal nameplate on all equipment. Mechanically fastened with raised or recessed letters.
- .2 Provide Underwriters' Laboratories or CSA registration plates, as required by respective agency.
- .3 Manufacturer’s nameplate to indicate size / capacity, equipment model, manufacturer's name, serial number, voltage, cycles, phase, power of motors, and any other relevant parameters for equipment identification.
- .4 Locate nameplates so that they are easily read. Do not paint over nameplates.

.2 Component Nameplates:
- .1 Provide laminated plastic plates with black face and white center of minimum size 90 x 40 x 2.5 mm nominal thickness, engraved with 6 mm high lettering. Use 25 mm lettering for major equipment.

.2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.
.3 Identify equipment type, number and service (e.g. Booster Pump No. 2).
.4 Submit list of nameplates for review prior to engraving.

.3 Pipe and Valve Identification:
.1 Piping is to be labeled to show the commodity (e.g. Hot Potable Water)
.2 Labels are to be colored to the commodity:
.1 Cold Potable Water – Blue on White
.2 Hot Potable Water – Red on White
.3 Natural Gas – Black on Yellow
.4 Drain – Green on White
.3 Labels to be self adhesive and permanent in hot and cold conditions

.4 Valve Identification:
.1 Each valve shall bear the manufacturers name to trademark, size, flow direction, tag number if available, and reference symbol to indicate the service conditions for which the manufacturer guarantees the valve.
.2 Fasten identification tags to each valve as shown within the Contract Document using small stainless steel chains.
.3 Provide 40 mm high, 1.5 mm thick rectangular polished stainless steel identification tags with embossed black alpha-numeric identification markings minimum 35 mm high and 3.2 mm thick, mounted to be easily read
.4 Each valve tag is to display the valve tag number only. The Contractor shall verify the valve tag list with the Owner's Representative via the submittals process prior to fabrication

2.4 NUTS, BOLTS AND GASKETS

.1 Refer to specific piping specifications.

.2 Nuts with integral washers are NOT ACCEPTABLE.

2.5 PIPE, TUBE, AND FITTINGS – GENERAL

.1 Refer to individual Division 22 Piping Sections for pipe, tube, and fitting materials and joining methods.

.2 Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.6 PIPE SIZE CONVERSION

.1 The following conversions for nominal dimeter are applicable within the Contract Documents, and follow ASME / ANSI B36.10 and ASME / ANSI B36.19
.1 6 mm (1/8 in)
.2 8 mm (1/4 in)
.3 10 mm (3/8 in)
.4 15 mm (1/2 in)
.5 20 mm (3/4 in)
.6 25 mm (1 in)
.7 32 mm (1.25 in)
.8 40 mm (1.5 in)
.9 50 mm (2 in)

.10 65 mm (2.5 in)
.11 80 mm (3 in)
.12 90 mm (3.5 inch)
.13 100 mm (4 in)
.14 125 mm (5 in)
.15 150 mm (6 in)
.16 200 mm (8 in)
.17 250 mm (10 in)
.18 300 mm (12 in)
.19 350 mm (14 in)
.20 400 mm (16 in)
.21 450 mm (18 in)
.22 500 mm (20 in)

2.7 COMPATIBILITY

.1 All substances, materials or components that are in contact with chemicals shall be suitable for handling the specified chemical service.

2.8 GROUT

.1 Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
  .1 Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  .2 Design Mix: 5000-psi, 28-day compressive strength.

2.9 PRODUCT REQUIREMENTS

.1 Refer to and comply with individual technical specifications

2.10 PRODUCTS USED IN DESIGN

.1 Refer to the individual valve specifications.

2.11 MANUFACTURERS

.1 Acceptable Manufacturers are selected based upon the following criteria
  .1 Performance / compatibility of supplied equipment
  .2 Historical level of service provided by the manufacturer
  .3 Historical level of service provided by the local distributors / representatives
  .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Request for Alternate or Substitute Products or Equipment
  .1 The products listed in the individual sections are to be used as a guide and do not imply exclusion of unlisted manufacturers and models.
  .2 The Contractor to submit written request complete with all submittal information on the requested alternate product or equipment.
  .3 Requested alternates or substitutions will be assessed based on the Owner requirements and against the product/equipment used as the basis of design. Just because there is a request does not guarantee that the request will be accepted.

2.12 HYDROSTATIC TESTING

.1 Supply all potable water, temporary pipework, fixings and fittings to complete hydrostatic testing.

.2 Dispose of water used during the test in a responsible manner as to not damage the surrounding area, environment, infrastructure or Work.

.3 For pressure testing requirements of process tanks, process piping, chemical systems, etc. refer to individual technical specifications.

3 Execution

3.1 INSTALLATION

.1 The Contractor shall install all products in accordance with the most stringent requirements, whenever a requirement conflict occurs.

.2 Products installed shall be new and of uniform construction.

.3 Equipment shall be installed and tested in strict accordance with manufacturer's recommendations and governing rules, regulations, and codes.

.4 Erect equipment on foundations complete with anchor bolts, suitably sized by the Contractor and verified by the Manufacturer.

.5 Special care to be taken to ensure true alignment of parts, especially pumps and electrical drives. Align the units after their sole plates have been shimmed at the anchor bolts. Recheck alignment after securing equipment to its foundation before grouting sole plates in place.

.6 Recheck alignment of equipment handling hot fluids, during initial operation.

.7 Maximum headroom, minimum interference with free use of surrounding areas, and access to equipment, shall be the governing requirements applied to all work. Where the Contractor identifies conflicts that do not meet these requirements, the Contractor shall inform the Owner’s Representative in writing in a timely manner.

.8 Piping and Fittings
- .1 Refer to Section 22 10 01 Plumbing Piping.

.9 Piping and equipment shall be installed square and parallel to building lines unless otherwise noted.

.10 Measuring Devices
- .1 Install measuring devices supplied under the Contract Documents.
- .2 Provide all pipes and fittings required for complete installation of measuring devices including reducers, weldolets, shut off valves, flushing connections, drains, bolts, nuts, washers and gaskets, etc.
- .3 Provide and install weldolets for pressure sensors and pressure switch sensors on metal piping systems.
  - .1 Back weld weldolets installed on steel or stainless-steel pipes.
- .4 Use tapped saddles for pressure sensors and pressure switch sensors on plastic piping systems.

.5 Pipe couplings, tapped saddles, valves, flexible connectors and fittings shall
  .1 Be of materials similar to that of the piping to which they are connected, and
  .2 Have pressure and temperature ratings equivalent to that of the piping to which they are connected.
.6 Orient isolating valves and all indicators in accordance with the following:
  .1 Minimal interference with structures and with any other equipment or piping.
  .2 Show valve position indicator from a point no less than 2.5 m away and from an individual's position, compatible with normal plant operation.
  .3 Allow for ease of maintenance and disassembly.
  .4 Re orient as required to satisfy the above conditions or any other special condition specified elsewhere in the Contract Documents.

3.2 PRESSURE TESTING

.1 Prior to the commencement of any testing of the system using water, complete pressure testing of equipment and pipework.

.2 Supply all potable water, air and insert gases required for pressure testing

.3 Supply of pumps, compressors, gauges etc. required for pressure testing

.4 Install threadolets, air relief valves, and line fitting valves necessary to complete pressure testing. All equipment will be removed after testing and threadolets plugged.

.5 Cap and plug all lines which are normally open-ended and remove on completion of a successful pressure test.

.6 Isolate and protect all low pressure equipment and appurtenances during pressure testing so as not damage any equipment.

.7 Where hydrostatic testing is completed with water, ensure all lines / equipment are filled with water. Bleed air from all high spots.

.8 Where defective material of equipment is identified, repair or replace using new material and re-test.

.9 Dispose of water used during the test in a responsible manner as to not damage the surround area, environment, infrastructure, or Work.

.10 For pressure testing requirements of pipework, fittings and equipment refer to individual technical specifications.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 All pipes must be cleaned, flushed, and for potable water piping properly disinfected prior to being put into service.

END OF SECTION

1 General

1.1 INTENT

.1 To define common requirements for all plumbing piping and valves to be procured and installed as part of the Work.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other Sections of the Contract Documents shall form part of and be read in conjunction with this Section

1.2 REFERENCES

.1 AGA Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

.2 ASME B16.3 - Malleable Iron Threaded Fittings.

.3 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.5 ASME B31.1 - Power Piping.

.6 ASME B31.2 - Fuel Gas Piping.

.7 ASME B31.9 - Building Services Piping.

.8 ASME SEC IX - Welding and Brazing Qualifications.

.9 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.10 ASTM B32 - Solder Metal.

.11 ASTM B42 - Seamless Copper Pipe, Standard Sizes.

.12 ASTM B43 - Seamless Red Brass Pipe, Standard Sizes.

.13 ASTM B68 - Seamless Copper Tube, Bright Annealed.

.14 ASTM B75 - Seamless Copper Tube.

.15 ASTM B88 - Seamless Copper Water Tube.

.16 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

.17 ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.18 ASTM B302 - Threadless Copper Pipe, Standard Sizes.

.19 ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.20 ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.

.21 ASTM D2239 - Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

.22 ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

.23 ASTM D2447 - Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

.24 ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

.25 ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

.26 ASTM D2564 - Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

.27 ASTM D2609 - Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.

.28 ASTM D2661 - Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

.29 ASTM D2662 - Polybutylene (PB) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

.30 ASTM D2665 - Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

.31 ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

.32 ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.33 ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer, Pipe, and Fittings.

.34 ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.

.35 ASTM D2855 - Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

.36 ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.37 ASTM E814 - Fire Tests of Through-Penetration Fire Stops.

.38 ASTM F437 - Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.39 ASTM F438 - Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

.40 ASTM F439 - Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.41 ASTM F441 - Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

.42 ASTM F442 - Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe(SDR-PR).

.43 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.44 ASTM F493 - Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

.45 ASTM F628 - Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core.

.46 ASTM F679 - Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

.47 ASTM F708 - Design and Installation of Rigid Pipe Hangers.

.48 ASTM F1281 - Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.

.49 ASTM F1282 - Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.

.50 AWS A5.8 - Filler Metals for Brazing and Braze Welding.

.51 AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping Systems.

.52 AWWA C651 - Disinfecting Water Mains.

.53 AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe (and Fabricated Fittings), 4 inch - 12 inch (100 mm - 300 mm), for Water Distribution.

.54 AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch - 3 inch (13 mm - 76 mm) for Water Service.

.55 AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch - 48 inch (350 mm - 1200mm).

.56 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

.57 MSS SP-67 - Butterfly Valves.

.58 MSS SP69 - Pipe Hangers and Supports - Selection and Application.

.59 MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

.60 MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.61 MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

.62 MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

.63 MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.

.64 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

.65 MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

.66 NCPWB - Procedure Specifications for Pipe Welding.

.67 NFPA 54 - National Fuel Gas Code.

.68 NFPA 58 - Liquified Petroleum Gas Code.

.69 UL 1479 - Fire Tests of Through-Penetration Firestops.

1.3 CONDITIONS AND DEFINITIONS

.1 The term “valve” and “process valve” are interchanged and shall have the same definition

.2 Other Sections provide details and requirements of valve types, referred to as “valve type specifications”.

.3 Valve type specifications contains a series of similar valves types, referred to by a three-digit number, prefixed by a “V” or a “FCV” or other abbreviations as found in the contract documents.

1.4 SUBMITTALS

.1 Product Data:
- .1 Provide data on pipe materials,
  - .1 pipe fittings,
  - .2 valves,
  - .3 and accessories.
- .2 Provide manufacturers catalogue information.
  - .1 Indicate valve data and ratings.
  - .2 Indicated pipe data and ratings.

1.5 DELIVERY, STORAGE, AND PROTECTION

.1 Supply all valves to site within shipping containers with labeling in place.

.2 Inspect for damage and report in writing.

.3 When moving valves chains, cables and ropes shall not be placed through valve ports or attached to actuators / operators, cylinders or hand wheels. Slings shall be used either around the valve body or with bolts or rods through the flange bolt holes.

.4 Provide temporary protective coating on all cast iron and steel valves.

.5 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation of valve.

.6 Valves shall not be rested on cylinders, hand wheels or operating shafts.

.7 Protect valves and pipes from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of the completed system.

.8 Store as per the manufacturer's recommendations.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

.2 Compatibility issues with regards to fluids conveyed, operation, safety and service life are to be communicated to the Owner’s Representative through the shop drawing review process, and recommendations for alternates provided.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.3 PERFORMANCE REQUIREMENTS

.1 Refer to the individual piping specifications.

.2 Refer to the individual valve specifications.

2.4 PRODUCT REQUIREMENTS

.1 It shall be the responsibility of the Contractor to furnish and install all piping systems specified herein and shown on the contract drawings. Each system shall be installed complete with all applicable fittings, hangers, supports, anchors, expansion joints, flexible connections, valves, and accessories to provide a functional system as designed. In addition, to all testing, disinfection and encasement shall be the responsibility of the Contractor.

.2 The Contractor shall provide all tools, equipment, materials, and supplies necessary and shall perform all labor necessary to complete the work specified herein and indicated on the drawings.

.3 The Contractor shall provide all testing apparatus necessary to perform testing as required by the contract documents. The Contractor shall provide any equipment necessary for inspection of and testing of piping systems specified.

.4 Piping shown on drawings and specified herein is intended to define the general layout, configuration, routing, pipe size and type only. It is the responsibility of the Contractor to provide a complete system in accordance with the contract drawings and requirements set forth herein. All details necessary to provide a complete system as specified herein are the responsibility of the Contractor. The Contractor shall provide all spools, spacers, adapters, connectors, and supports necessary to provide a complete and functional system. The Contractor shall furnish pipe supports, hangers, anchors, etc., in addition to those shown on the contract drawings, to provide a system as specified herein. The Contractor shall provide lay-out drawings of all piping systems prior to installation showing all piping, equipment, accessories, supports, etc.

.5 Confirmation of Dimensions:

.1 Coordinate valve diameter with pipework sizes provided within Process and Instrumentation Drawings.
.2 Coordinated and confirm face to face dimensions of all valves, as well as the dimensions of the various valve actuators / operators, to avoid conflict with other scopes within the Work.
.3 Contactor shall be responsible for adjustment of the connecting pipework to suit the valves supplied, in the event that the face to face dimensions or other details, vary from the Contract Documents.
.4 Make adjustments such that centerlines of shafts shall remain as shown within the Contract Documents, provided that actuators / operators have suitable clearance from all other items within the Work.
.5 Orient all valves within the piping to allow access to seat adjustment screws (where applicable), unless otherwise stated within the specific valve specification

.6 Pipe Expansion:
.1 Install piping to permit free movement of piping caused by thermal expansion and contraction except where it is anchored.
.2 Provide for expansion and contraction by installing suitable expansion pieces of flexible connectors where indicated in the Drawings and as is necessary if not shown on the drawings.
.3 Design expansion pieces or flexible connectors for the lengths of straight runs shown and the highest expected temperature differentials unless specified otherwise.
.4 All used expansion pieces and flexible connectors shall have similar ratings to the test pressures specified for the particular piping to which they are installed.
.5 Construct expansion pieces to limit turbulence and pressure drop. Where necessary, provide liners of materials compatible with the process fluid to prevent erosion and corrosion. In any case, provide liners for services when the process fluid is dirty or contains solids.
.6 Provide anchors, supports and guides where necessary to limit movements to those directions and magnitudes permitted for the specific joint or flexible connector. Anchors, supports and guides shall direct expansion towards expansion pieces or flexible connectors.
.7 Install expansion pieces and flexible connectors in accordance with the standards of the Expansion Joint Manufacturers Association, Inc.

.7 Corrosion Protection for Buried Piping:
.1 All buried ferrous metal piping shall be protected against corrosion with external protective covering. Coverings shall be continuous over the pipe joints.
.2 Acceptable products are yellow jacket by Shaw Pipe Protection, Denso tape, Polyken Wrap, or approved equivalent.
.3 Provide a magnesium anode on each section of buried ferrous piping.

.8 Pipe Annular Space Sealing
.1 When piping passes through a sleeve or cored hole in walls or floors and the annular space needs to be have a watertight seal the use of a modular seal will be used.
.2 The modular seal shall be compatible with the commodity that it is holding back.
.3 The fasteners of the modular seal must be type 316 stainless steel unless this is incompatible with the commodity that is being held back then the contractor will inform the Owner’s Representative and suggest an alternative.

.9 Alignment and Grade of Piping:
  .1 Establish the pipe location and grade in accordance with the drawings.
  .2 Install piping parallel to building walls and ceilings.
  .3 Determine exact location of each pipe in the field with respect to adjacent and interconnecting piping and equipment.

2.5 PRODUCTS USED IN DESIGN

.1 Refer to the individual sections related to the piping or valves.

.2 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
  .1 Ensure that the performance and functionality of the specified system is maintained, and
  .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.6 MANUFACTURERS

.1 Acceptable Manufacturers
  .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
    .1 Refer to the individual specifications for acceptable manufacturers.
  .2 Acceptable Manufacturers are selected based upon the following criteria
    .1 Performance / compatibility of supplied equipment
    .2 Historical level of service provided by the manufacturer
    .3 Historical level of service provided by the local distributors / representatives
    .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Alternate and Substitute Products
  .1 The products listed in the individual valve sections are to be used as a guide and do not imply exclusion of unlisted manufacturers and models. Refer to Section 22 00 01 – General Plumbing Provisions

3 Execution

3.1 INSTALLATION

.1 Installation of Piping – General:
  .1 Labour in these specifications shall be performed by holders of current certificates of proficiency issued pursuant to the Trademan's Qualification Act.
  .2 Welding shall conform to qualified procedures which satisfy the ASME Boiler and Pressure Vessels Code, ANSI Code for Power Piping and all Provincial and local codes having authority.
  .3 Welding shall be performed only by holders of a valid Class B, Pressure Welders Certificate issued by the Government of the Provincial Department of Labour.
  .4 Pipes shall be adequately supported on concrete pedestal stanchions or from galvanized or stainless steel pipe hangers/supports as per Section 40 05 07 Hangers and Supports for Process Piping.
  .5 The Owner's Representative reserves the right, if he deems it desirable, to have flanged joints unbolted at the equipment flanges to determine if there is any misalignment.

.6 Flanged joints shall be made up square with even pressure upon the gaskets and shall be watertight.
.7 After fabrication of piping, ensure that piping is internally cleaned.
.8 Rack and group pipe and conduit runs to achieve a neat and orderly installation.
.9 Permit equipment maintenance and disassembly by use of approved couplings, unions or flanges to minimize disturbance to connecting piping and without interference from building structure or other equipment.

.2 Flanges Bolting to Valves:
.1 Do not weld or solder adjacent to flanges on butterfly valves when the valves are in place.
.2 If these valves are bolted in place for alignment purposes, the flanges may be tack welded, but particular care shall be taken not to overheat and damage the rubber seating on the valves. The valves must be removed prior to the completion of the welding or soldering.
.3 All gasket surfaces, flange faces and butt welding connection of valves shall be thoroughly cleaned, greased and protected with suitable wood, metal or other substantial type covering to ensure their full protection.

.3 Bolted Connection:
.1 Before installing bolted connections, pipe ends and gaskets shall be absolutely clean.
.2 Gaskets shall be lubricated with soapy water and bolts with thread lubricant.
.3 Bolts shall be tightened progressively by the crossover method and not in rotation around the joint. Bolts shall be torqued to the manufacturer's requirements. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of nut and bolt heads.

.4 Screwed Joints:
.1 Screwed joints shall be made up with thread compound suitable for the piping material and fluid conveyed.
.2 Compound shall be applied to the male thread only.
.3 Threads shall be clean, machine cut, and all pipe ends shall be reamed after cutting to remove any burrs.
.4 Before erection, each length of pipe shall be upended and rapped to dislodge dirt and scale.
.5 Pipelines shall be installed with as few joints as possible.
.6 Short lengths of pipe coupled together shall not be used.
.7 If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied.
.8 Threads shall not be caulked.
.9 In general, reducing fittings shall be used for changes in pipe sizes.
.10 Bushing shall not be used.
.11 Nipples in screwed piping shall be shoulder nipples.
.12 Close nipples shall not be used unless specifically indicated.
.13 All exposed male threaded parts shall be greased and protected with metallic or other substantial type protectors.
.14 All exposed female threaded openings shall be cleaned and closed with pipe plugs or steel or plastic snap-in protectors.

.5 Dielectric Couplings:
.1 Provide wherever pipes of dissimilar metals are jointed.

.2 Provide insulating unions for pipe sizes NPS 50mm (2 inch) and under and flanges for pipe sizes over 50 mm (2 inch) NPS.
.3 Provide felt or rubber gaskets.

.6 Piping Built into Walls, Floors, Etc.:
.1 Piping to be built into walls, floors, etc., shall be located to position the bolting holes in flanged piping to the correct orientation to receive valve and other fittings mating to them.
.2 Piping to be built into mass concrete or reinforced concrete walls, floors, etc., shall be cast in at the time of concreting the wall, floor, etc., and box outs will not be permitted.
.3 Remove the coating from metallic pipes, including sleeves and spools, to be cast in concrete, to permit a good bond.
.4 Set sleeves and spools accurately before concrete is placed or masonry built.
.5 Where indicated on drawings, provide water tight mechanical seal system where pipes pass through floors and walls.
.1 For locations of penetrations to be determined in the field. These penetrations shall be core bit drilled of recommended diameter by seal manufacturer for each pipe size.
.6 Where pipes pass through walls and ceilings, install split type, chrome plated or spun aluminum escutcheons designed to fit around the pipe and the insulation, neatly against the wall or ceiling, completely concealing the sleeve. Fasten the escutcheons to the pipes with stainless steel set screws.
.7 Where pipes or sleeves are to be grouted in place, an approved non shrink, non-metallic grout mixture shall be used. All exposed non-metallic, non-shrink grout faces shall be left recessed 25 mm from final surface and will be fitted and finished with Portland Cement grout. Such sleeves or pipes shall not be disturbed until the grout is properly cured.

.7 Valves
.1 All appurtenances, valves, operating units, controls, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified.
.2 All valves shall be adequately braced to prevent warpage and bending under the intended use.
.3 All valves shall be firmly supported to avoid undue stresses on the pipe and the valve itself.
.4 Before installing any valve, the pipeline shall be inspected to ensure that no foreign debris or objects are present or may work loose and prevent the valve from closing.
.5 All valves should be aligned carefully to avoid excessive strain on flanges.
.6 Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these accessories so that all components are compatible and operating properly.
.7 All valves shall be field tested following installation to demonstrate that the valve operates under field conditions in a manner consistent with the design of the system.
.8 All valves shall be installed to provide easy access for operation, removal, and maintenance, and to avoid conflicts between valve actuators / operators and structural members or handrails.
.9 PVC Valves
.1 Ensure that glue and materials used provide excellent chemical resistance to the commodity (liquid) flowing through the valve.

.2 Install valves in accordance with manufactures instructions, including but not limited to use of appropriate tools, torque and backing rings where applicable.

3.2 IDENTIFICATION

.1 Refer to Section 22 00 01 – General Plumbing Provisions

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 All pipe must be cleaned, flushed, and properly disinfected prior to being put into service.

3.4 TESTING AND VERIFICATION

.1 Field testing of piping:
- .1 Provide all materials, equipment, tools and labor required to perform the tests specified herein.
- .2 Furnish certificate from manufacturer or approved laboratory verifying calibration and accuracy of test instruments.
- .3 Should any item fail testing, it will be corrected by the Contractor until a successful test is achieved.
- .4 All tests shall be witnessed by the Owner's Representative.
- .5 The Contractor shall be responsible for all equipment and components during testing and shall be liable for damage in the event of injury and/or property damage.
- .6 Provide temporary supports, if necessary, to support the weight of test liquid for piping designed for vapor or gas.
- .7 Provide temporary restraints or isolate expansion joints which cannot sustain the reactions due to test pressure.
- .8 All plugged ends shall be adequately reinforced to withstand test pressures.
- .9 Isolate from the piping, equipment that is not to be subjected to the test pressure.
- .10 Pipework may be tested as a whole or in sections.
- .11 The section of pipe to be tested shall be filled with clean water and have all air removed 24 hours prior to testing.
- .12 Immediately prior to testing, the pipe shall be checked for loss of water and filled accordingly. Great care shall be taken to ensure there are no trapped pockets of air.
- .13 All pressure pipes shall be pressurized to 689 kPa (100 psi), all gravity flow piping shall be tested under system head pressure, and the pressure shall hold constant for two hours with no appreciable pressure loss as determined by the Owner's Representative. Consideration should be given to air temperature differentials when testing with water.
- .14 If leaks are detected, at no cost to the Owner the Contractor shall repair and retest until no leakage is detected.
- .15 Drain piping following successful completion of testing.
- .16 Pipe test shall be using clean water at ambient temperature except where there is risk of damage due to freezing. Another fluid may be used (after being approved by the Owner's Representative) if it is safe for workmen and compatible with the piping material.
- .17 During testing all valves must be in the open position.
- .18 Leaks in screwed fittings shall be corrected by remaking joints, leaks in welded joints shall be cut out and re-welded, and leaks in copper lines shall be corrected by remaking joints. Caulking will not be permitted.
- .19 Furnish written test reports to the Owner's Representative noting the tests made and any adjustments or repairs that were made.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials identification and installation for all piping, fitting, valves, piping specialties and support devices.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.3 PRODUCT REQUIREMENTS

.1 Sanitary Sewer Pipe and Fittings

Item	Size	Description
Interior Pipe	40 mm to 600 mm	PVC DWV Pipe: ASTM D2665 (CSA B181.2)
Buried/Exterior Pipe or Pipe cast in walls	40 mm to 600 mm	PVC DWV Pipe: ASTM D2665 (CSA B181.2)
Pipe Joints	40 mm to 600 mm	Solvent welded with ASTM D2564
Pipe Fittings	40 mm to 600 mm	PVC DWV Pipe: ASTM D2665 (CSA B181.2)
Underground Couplings	40 mm to 600 mm	Use the type as shown on the drawings Self-restraining type: Couplings consist of a ductile iron housing to ASTM A536 and coated with NSF-61 approved epoxy coating. The restraint system shall consist of gripping surfaces. The gasket to be NBR. The system shall meet AWWA C219, C111 and ASTM D2000. All couplings are to be wrapped in Denso tape.
Bolting	All	Type 304, ASTM A193, Grade B8M hex head bolts and ASTM A194 Grade 8M hex head nuts and type 304 Stainless Steel Washers. Nuts with integral washers are not acceptable.
Hangers and supports	Up to 100mm	Adjustable swivel clevis (galvanized), strut and strut clamps, galvanized riser clamps at floor penetrations

.2 Domestic Water Pipe, Fittings and Valves

Item	Size	Description
Interior Pipe	15mm to 50 mm	Copper Tubing Type L, ASTM B88
Buried/Exterior Pipe or Pipe cast in walls	15mm to 50 mm	Copper Tubing Type K, ASTM B88
Pipe Joints	15 mm to 50 mm	Solder, ASTM B32, Grade 95-5
Pipe Fittings	15 mm to 50 mm	ASME B16.18, cast copper or ASME B16.22, wrought copper and bronze
Flanges	15 mm to 50 mm	Class 150 Bronze slip-on
Unions	15 mm to 50 mm	Class 150 bronze ground and soldered joints
		Use dielectric unions for dissimilar metals
Bolting	All	Type 304, ASTM A193, Grade B8M hex head bolts and ASTM A194 Grade 8M hex head nuts and type 304 Stainless Steel Washers. Nuts with integral washers are not acceptable.
Gaskets	All Flanges	3.2 mm thick Red Rubber, ring type for raised face flanges and full face type for flat face flanges.
Thread Lubricant	50 mm & smaller	Teflon tape and/or paste that complies with NSF 61
Valves (isolation)	15 mm to 50 mm	Forged Brass Ball Valve, ANSI B16.22 Soldered ends, Full port, 2 piece, chrome ball, Teflon seats, blowout proof stem, adjustable packing, Lever handle, Class 150/600WOG
Hose Bibbs (exterior)		Frost-proof automatic self-draining wall hydrant. Bass body with nickel-plated finish, brass vacuum breaker mechanism, metal handle. Suitable to install with wall thickness between 100 mm and 350 mm. Outlet shall be 20 mm hose outlet.
Hose Bibbs (interior)		20 mm brass hose bibb
Valves (backflow prevention) to be supplied with air gap and piped to drain	15 mm to 50 mm	Reduced pressure zone assembly, quarter turn shutoffs, internal pressure differential relief valve between two positive seating check valves, lead free construction, ball valve test cocks, air gap drain, to AWWA C511, CSA B64.4
Hangers and supports	15 mm to 50 mm	Adjustable swivel split ring copper clad, strut and strut clamps with plastic inserts.

.3 Natural Gas Piping

Item	Size	Description
Interior Pipe	15mm to 65 mm	ASTM A53, carbon steel, welded, Sch 40
Buried/Exterior Pipe or Pipe cast in walls	15mm to 65 mm	ASTM A53, carbon steel, welded, Sch 40. With AWWA C105 polyethylene jacket or double layer, half lapped 10mil polyethylene tape.
Pipe Joints	15 mm to 50 mm	Threaded or welded as required or shown on the drawings.
Pipe Fittings	15 mm to 50 mm	ASME B16.3 Malleable Iron or ASTM A234 Forged Steel welding type
Unions	15 mm to 50 mm	Class 150, malleable iron ground and threaded
Thread Lubricant	50 mm & smaller	Teflon tape and paste that is compatible with natural gas
Valves (isolation)	25 mm & smaller	Foraged Brass ball valve, ASME B16.44, CGA-CR91-002, square operating nut, Threaded ends, blowout proof stem, Teflon seats, suitable for natural gas.
Hangers and supports	15 mm to 50 mm	Adjustable swivel split ring, strut and strut clamps

2.4 PRODUCTS USED IN DESIGN

.1 Domestic Water Valves
- .1 Ball Valves: MAS B-4
- .2 Reduced Pressure Backflow Preventor: Watts Series LF-009
- .3 Hose bibbs (exterior): Watts FHB Series
- .4 Hose bibbs (interior): Nibco model C56-VB

.2 Natural Gas Valves
- .1 BrassCraft
- .2 MA Stewart
- .3 Red-White Valve Corp.

.3 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
- .1 Ensure that the performance and functionality of the specified system is maintained, and
- .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
- .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
  - .1 Ball Valves
    - .1 BrassCraft

.2 MA Stewart
.3 Red-White Valve Corp MA Stewart.

.2 Reduced Pressure Backflow Preventors
.1 Watts
.2 Zurn
.3 Apollo

.3 Natural Gas Valves
.1 BrassCraft
.2 MA Stewart
.3 Red-White Valve Corp

.4 Approved substitution.

.2 Acceptable Manufacturers are selected based upon the following criteria
.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work.

3 Execution

3.1 INSTALLATION

.1 Refer to Section 22 10 01 Common Requirements for Plumbing Piping and Valves.

3.2 IDENTIFICATION

.1 Refer to Section 22 00 01 – General Plumbing Provisions

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 All pipe must be cleaned, flushed, and properly disinfected prior to being put into service.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials and installation for all plumbing specialties.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.3 PRODUCT REQUIREMENTS

.1 Floor Drain (FD-1):
- .1 Epoxy coated.
- .2 Cast iron two piece body
- .3 Double weep holes,
- .4 Reversible clamping collar,
- .5 No Hub outlet,
- .6 Round, adjustable nickel-bronze strainer 178mm (7”) diameter.

.2 Floor Drain (FD-2):
- .1 Epoxy coated.
- .2 Cast iron two piece body
- .3 Double weep holes,
- .4 Reversible clamping collar,
- .5 No Hub outlet,
- .6 Round, adjustable nickel-bronze strainer 127mm (5”) diameter
- .7 102mm (4”) x 229mm (9”) oval nickel-bronze funnel

.3 Cleanouts:
- .1 Epoxy coated.
- .2 Cast iron body
- .3 No Hub outlet,
- .4 Round, adjustable nickel-bronze top 127mm (5”) diameter
- .5 Removable gas tight gasketed brass cleanout plug.

.4 Washdown Hoses and Hose Reels
- .1 Washdown Hoses
  - .1 Provide one 15.24 m (50-feet) wash-down hoses with 20 mm brass male and female thread fittings.
  - .2 Provide heavy duty spray nozzle for each hose. Nozzles shall be rated for 1034 kPa
- .2 Hose Reels/Hangers
  - .1 At each location shown on the Contract Drawings provide one heavy duty wash-down hose hanger, with accessories required to mount on the wall. Hose reels/hangers shall come with suitable fittings to connect inlet piping and 20 mm wash-down hoses

2.4 PRODUCTS USED IN DESIGN

.1 Floor Drains and Cleanouts
- .1 FD-1
  - .1 Watts FD-100
- .2 FD-2
  - .1 Watts FD-100-EG
- .3 CO-1
  - .1 Watts CO-200-R

.2 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
- .1 Ensure that the performance and functionality of the specified system is maintained, and
- .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
- .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
  - .1 Floor Drains and Cleanouts
    - .1 Watts
    - .2 Zurn
  - .2 Approved substitution.
- .2 Acceptable Manufacturers are selected based upon the following criteria
  - .1 Performance / compatibility of supplied equipment
  - .2 Historical level of service provided by the manufacturer
  - .3 Historical level of service provided by the local distributors / representatives
  - .4 Location of spare parts and repair / service facilities in proximity to the Place of Work.

3 Execution

3.1 INSTALLATION

.1 Refer to Section 22 10 01 Common Requirements for Plumbing Piping and Valves.

.2 Install to manufacturer's instructions.

.3 Extend floor drains to finished floor, concrete to slope to drain.

.4 Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

.5 Install floor cleanouts at elevation to accommodate finished floor.

3.2 IDENTIFICATION

.1 Refer to Section 22 00 01 – General Plumbing Provisions

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 All pipe must be cleaned, flushed, and properly disinfected prior to being put into service.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials and installation for all plumbing fixtures.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.3 PRODUCT REQUIREMENTS

.1 Water Closet (WC-1):
- .1 Floor mounted standard height
- .2 Two piece, with insulated tank and elongated bowl
- .3 Full seat with lid
- .4 Single low flush 4.8Lpf
- .5 White Vitreous China
  - .1 CAN/CSA B45
  - .2 ASME A112.19M
- .6 Accessories:
  - .1 Supply with quarter turn shutoff
  - .2 Stainless steel braided supply hose

.2 Sink:
- .1 Wall hung sink
  - .1 White Vitreous China
  - .2 Oval shape
  - .3 Overflow Drain
- .2 Holes on 100mm (4”) Centers, with 3 holes
- .3 Complete with Faucet
  - .1 Chrome plated
  - .2 Two Handle
  - .3 100mm (4”) centers, deck mount
- .4 Accessories:
  - .1 Quarter turn shutoffs
  - .2 Braided stainless steel supply hoses
  - .3 600x600 Mirror to be mounted above the sink.

2.4 PRODUCTS USED IN DESIGN

.1 Water Closet
- .1 WC-1
  - .1 American Standard Mainstream Elongated complete toilet

.2 Sink
- .1 American Standard

.1 Model 0355.012
.2 Faucet
.1 Moen Adler

.3 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
.1 Ensure that the performance and functionality of the specified system is maintained, and
.2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
.1 The following manufactures have been identified as potential suppliers of the required items / equipment.
.1 Water Closet
.1 American Standard
.2 Approved substitution.
.2 Acceptable Manufacturers are selected based upon the following criteria
.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work

3 Execution

3.1 INSTALLATION

.1 Refer to Section 22 10 01 Common Requirements for Plumbing Piping and Valves.

.2 Install to manufacturer's instructions.

.3 Install each fixture with trap, easily removable for servicing and cleaning.

.4 Install escutcheons on supply lines.

.5 Install and secure fixtures in place with bolts.

.6 Seal fixtures to wall and floor surfaces with sealant.

3.2 IDENTIFICATION

.1 Refer to Section 22 00 01 – General Plumbing Provisions

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 All equipment must be cleaned, flushed, and properly disinfected prior to being put into service.

3.4 TESTING AND VERIFICATION

.1 Test all fixtures to verify performance.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials and installation for all plumbing equipment.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 22 00 01 – General Plumbing Provisions.

2.3 PRODUCT REQUIREMENTS

.1 Tankless Electric Water Heater
- .1 Compact, on demand hot water.
- .2 Connections: 15mm (1/2") NPT.
  - .1 Rated for 25 psi minimum and 150 psi maximum.
- .3 Electrical: 220 Volt, 6kW.
- .4 External digital display and temperature control adjustable by 1 deg increments, temperature can be displayed in either Celsius or Fahrenheit.
  - .1 Standard temperature settings adjustable 80°F to 140°F.
  - .2 Temperature accuracy +/- 1° at steady state flow.
- .5 Utilizes and flow meter with a 0.3gpm activation point.
- .6 Copper immersion single heating element with brass terminations.
- .7 Temperature/Pressure valve.
- .8 Drain valve.

2.4 PRODUCTS USED IN DESIGN

.1 Water Heater
- .1 Rheem model RETEX-06

.2 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
- .1 Ensure that the performance and functionality of the specified system is maintained, and
- .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
- .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
  - .1 Water Heater
    - .1 Rheem
  - .2 Approved substitution.
- .2 Acceptable Manufacturers are selected based upon the following criteria

.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work.

3 Execution

3.1 INSTALLATION

.1 Refer to Section 22 10 01 Common Requirements for Plumbing Piping and Valves.

.2 Install to manufacturer's instructions.

.3 Co-ordinate with plumbing piping and related electrical work to achieve and operating system.

3.2 IDENTIFICATION

.1 Refer to Section 22 00 01 – General Plumbing Provisions

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 All equipment must be cleaned, flushed, and properly disinfected prior to being put into service.

3.4 TESTING AND VERIFICATION

.1 Test all equipment to verify performance.

END OF SECTION

DIVISION 23

HEATING, VENTILATION AND AIR CONDITIONING

1 General

1.1 INTENT

.1 This section refers to materials and installation for heating and ventilation equipment.

1.2 CONDITIONS AND DEFINITIONS

.1 The terms Manufacturer and Supplier are interchangeable and have the same meaning with respect to the interpretation of this Section.

1.3 REGULATORY REQUIREMENTS

.1 Contractor is responsible to comply with all the latest versions of Regulatory Requirements and Codes whether specifically mentioned in the Contract Documents or not.

.2 Refer to the Natural Gas and Propane Installation Code

1.4 SUBMITTALS

.1 Contractor to submit individual submittals for each product or piece of equipment.

.2 “Bulk” submittals will be returned, “Not Reviewed”.

.3 Refer to individual Heating and Ventilation specifications for additional submittal requirements.

1.5 CONTRACTOR RESPONSIBILITIES

.1 The Contractor shall provide all tools, equipment, materials, and supplies necessary and shall provide all labor necessary to complete the Work specified herein and within the Contract Document to provide a complete and functional system.

.2 Contractor to coordinate installation of natural gas service with the gas utility.

.3 Coordinate installation of electrical and control requirements with the electrical contractor in order to achieve the operating sequence specified in Section 23 06 05.

.4 Connection of all electrical devices to be done by the electrical contractor.

.5 Provide all fuel fired furnaces, heaters and equipment shown on drawings and specified herein complete with supports, thermostats and controls.

.6 Provide all air handling louvres, dampers, fans, blowers, screens, diffusers, grilles and registers shown on drawings and specified herein complete with supports, actuators and controls.

.7 Submit shop drawings for all products and pieces of equipment.

.8 Provide start-up and commissioning of all systems.

.9 Provide operations and maintenance data.

1.6 EXAMINATION

.1 The Contractor shall review the Contract Documents and obtain additional dimensions and details from the Place of Work. Accurate dimensions shall be verified by actual measurements by the Contractor.

.2 Should the Contractor wish to change the location of equipment or pipework, they shall submit a request to the Owner's Representative for acceptance. If accepted, such changes shall be made at no additional cost to the Owner or the Owner's Representative.

.3 No additional costs will be permitted for any additional labor or materials required for relocation of equipment due to interference with equipment of other trades, beams, joists, walls, etc., unless the conflict has been submitted and identified to the Owner's Representative in writing before closing of tenders.

1.7 NOTICES, PERMITS, AND CERTIFICATES

.1 Refer to Front End Conditions for additional information.

.2 The Contractor is responsible to obtain and pay for all permits required to complete the Work from the local authority having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver ducts and equipment in new and clean condition. Maintain end caps through shipping, storage, and handling to prevent damage and to prevent entrance of dirt, debris, and moisture into equipment and ducting.

2 Products

2.1 EQUIPMENT REQUIREMENTS

.1 All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.

.2 Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.

.3 Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.

.4 All equipment shall be designed for continuous operation unless stated otherwise. All mechanical rotating parts shall be dynamically balanced for smooth operation. Limit vibration velocity at equipment bearings to 1 mm/s unless stated otherwise.

.5 All equipment shall be designed to achieve a noise level not exceeding 85 dB (A) measured at 1.5 m from the equipment, unless a more stringent level is stated elsewhere within the Contract Documents.

.6 Permit equipment maintenance and disassembly by use of approved couplings, unions or flanges to minimize disturbance to connecting piping and without interference from the building structure or other equipment.

.7 Provide accessible means to lubricate equipment.

.8 Provide accessible means to replace “lubricated lifetime bearings”.

.9 Pipe all drain lines to sump or floor drains unless stated otherwise within the Contract Documents.

2.2 ELECTRIC MOTORS AND EQUIPMENT

.1 Electrical work must conform to the Contract Documents.

.2 All motors and electrical equipment must be provided in accordance with the Contract Documents

.3 All motors and electrical equipment must be certified to CSA, IEEE, NEMA and EEMAC standards, where applicable to the equipment provided.

2.3 IDENTIFICATION

.1 Manufacturer's nameplates:
- .1 Provide corrosion resistant metal nameplate on all equipment. Mechanically fastened with raised or recessed letters.
- .2 Provide Underwriters' Laboratories or CSA registration plates, as required by respective agency.
- .3 Manufacturer’s nameplate to indicate size / capacity, equipment model, manufacturer's name, serial number, voltage, cycles, phase, power of motors, and any other relevant parameters for equipment identification.
- .4 Locate nameplates so that they are easily read. Do not paint over nameplates.

.2 Component Nameplates:
- .1 Provide laminated plastic plates with black face and white center of minimum size 90 x 40 x 2.5 mm nominal thickness, engraved with 6 mm high lettering. Use 25 mm lettering for major equipment.
- .2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.
- .3 Identify equipment type, number and service (e.g. Booster Pump No. 2).
- .4 Submit list of nameplates for review prior to engraving.

2.4 FASTENERS

.1 Use stainless steel fasteners.

2.5 SIZE CONVERSION

.1 The following conversions for nominal dimeter are applicable within the Contract Documents, and follow ASME / ANSI B36.10 and ASME / ANSI B36.19
- .1 6 mm (1/8 in)
- .2 8 mm (1/4 in)
- .3 10 mm (3/8 in)
- .4 15 mm (1/2 in)

.5 20 mm (3/4 in)
.6 25 mm (1 in)
.7 32 mm (1.25 in)
.8 40 mm (1.5 in)
.9 50 mm (2 in)
.10 65 mm (2.5 in)
.11 80 mm (3 in)
.12 90 mm (3.5 inch)
.13 100 mm (4 in)
.14 125 mm (5 in)
.15 150 mm (6 in)
.16 200 mm (8 in)
.17 250 mm (10 in)
.18 300 mm (12 in)
.19 350 mm (14 in)
.20 400 mm (16 in)
.21 450 mm (18 in)
.22 500 mm (20 in)

2.6 PRODUCT REQUIREMENTS

.1 Refer to and comply with individual technical specifications

2.7 PRODUCTS USED IN DESIGN

.1 Refer to the individual valve specifications.

2.8 MANUFACTURERS

.1 Acceptable Manufacturers are selected based upon the following criteria
- .1 Performance / compatibility of supplied equipment
- .2 Historical level of service provided by the manufacturer
- .3 Historical level of service provided by the local distributors / representatives
- .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Request for Alternate or Substitute Products or Equipment
- .1 The products listed in the individual sections are to be used as a guide and do not imply exclusion of unlisted manufacturers and models.
- .2 The Contractor to submit written request complete with all submittal information on the requested alternate product or equipment.

.3 Requested alternates or substitutions will be assessed based on the Owner requirements and against the product/equipment used as the basis of design. Just because there is a request does not guarantee that the request will be accepted.

3 Execution

3.1 INSTALLATION

.1 Install natural gas fired equipment in accordance with CAN1-B149.1-M80 and the Alberta Building Code.

.2 Install all equipment in accordance with the manufacturer’s recommendations.

.3 Use a 13 mm wide bead of butyl rubber caulking behind louvre frames before installing louvers. Fasten louvres to framed opening in wall with stainless steel sheet metal screws or lag bolts.

.4 The Contractor shall install all products in accordance with the most stringent requirements, whenever a requirement conflict occurs.

.5 Products installed shall be new and of uniform construction.

.6 Equipment shall be installed and tested in strict accordance with manufacturer's recommendations and governing rules, regulations, and codes.

.7 Erect equipment on foundations complete with anchor bolts, suitably sized by the Contractor and verified by the Manufacturer.

.8 Maximum headroom, minimum interference with free use of surrounding areas, and access to equipment, shall be the governing requirements applied to all work. Where the Contractor identifies conflicts that do not meet these requirements, the Contractor shall inform the Owner’s Representative in writing in a timely manner.

.9 Duct Work
.1 Refer to Section 23 31 13.

.10 Ducts and equipment shall be installed square and parallel to building lines unless otherwise noted.

3.2 CLEANING, FLUSHING AND DISINFECTION

.1 The Contractor shall ensure that all ducts and equipment is clean and ready for use by the Owner.

.2 New filters are to be installed just prior to project turnover.

END OF SECTION

1 General

1.1 INTENT

.1 This section refers to the heating and ventilation equipment used.

2 Products

2.1 FURNACES

.1 Dry Well
- .1 High efficiency (95%(Downflow))
- .2 Single Stage Multispeed ECM Gas Funace
- .3 60,000 BTU
- .4 Provide hot dipped galvanized stand for furnace.
- .5 Installed in the downflow position
- .6 Connect new ducting.
- .7 Connect gas line.
- .8 Locate combustion air and venting as per manufacturers instruction route lines as shown on the drawings
- .9 Connect electrical and controls
  - .1 Furnace to run continuously
  - .2 Install a flow switch in the downstream duct to connect to the SCADA system to give an air flow alarm
  - .3 Supply and install an induct temperature switch in the upstream ductwork, to be connected to the furnace burner controls. Set at 16 degree Celsius.
- .10 Acceptable manufacturers:
  - .1 Keeprite Model N95ESN0601714A

2.2 HRV

.1 Dry Well
- .1 Energy Recovery Ventilator
- .2 Cross-flow energy recovery core, easily removable.
- .3 Motors:
  - .1 Two PSC 2 speed single shafted
  - .2 120V 4.5A (total of 9A on high speed)
  - .3 ¼ Hp 1450 RPM
  - .4 MCA: 11.3, MOP:15
  - .5 Total on high speed 1080 W
- .4 50mm pleated MERV8 Filters in supply and exhaust air streams.
- .5 Blowers to easily slide in/out for servicing
  - .1 Centrifugal type rated at 329 L/s (700 CFM) free air delivery
  - .2 Each air stream to have a blower
- .6 Duct connections
  - .1 Four – 356x200 (14” x8”)
- .7 Cabinet
  - .1 Front and back access doors and electrical panel can be switched to either side.
  - .2 20 Gauge prepainted galvanized steel (G60)
  - .3 Insulated with foil faced insulation
- .8 Frost Prevention

.1 Temperature sensor activated, periodically shuts down supply motor.

.9 Mounting
.1 Contractor to provide galvanized support bracket hung by plated threaded rod.

.10 Connect electrical and controls
.1 HRV to be interlocked with the Furnace
.2 HRV to be set to run continuously at low speed

.11 Acceptable manufacturers:
.1 LifeBreath Model 530 ERV

2.3 BLOWER HEATER (BH-1)

.1 The Contractor is to supply and install the following blower heater
.1 Wetwell
.1 Power: 360W / 22,050 W,
.2 Voltage: 120/600VAC 3 Phase 60 Hz
.3 Construction:
.1 Outdoor free standing pipe mount
.2 Contractor to fabricate blower heater connection to pipe.
.3 12-gauge 5052 aluminium
.4 Fan: 775 L/s (1642 CFM) Max @0" SP, set @approx. 308 L/s (653 CFM) in auto-continuous duty, full fan speed intermittent duty
.5 Heating element:
.1 Incoloy Type, 0.375-inch diameter, 20 W/square inch.
.2 Temperature to be set at +8 degree Celsius at blower outlet
.6 Protections:
.1 Overheat – thermostats located at the top of the element housing and one on each element
.2 Low temperature – Temperature sensor at air discharge set at 0 degree Celsius
.3 Fan failure – Via tachometer output from the fan
.7 Ratings:
.1 CSA Certified for Ordinary Locations
.2 Enclosure Type 3R
.8 Accessories:
.1 Status Board c/w 15m of cable
.2 95ALM three alarm status output relay module
.9 Acceptable manufacturers:
.1 BH-1:
.1 Dexon Model SMDH22-1

2.4 EXTERIOR LOUVERS

.1 Extruded aluminum, welded assembly.

.2 Colour to match building trim.

.3 Flanged frame 100 mm deep.

.4 Weatherproof blades at 45 degrees, 114 mm apart.

.5 Galvanized insect screen.

.6 Acceptable product:
.1 Westvent XF-445W.
.2 Price DE439

2.5 REGISTERS (S-1)

.1 Aluminum construction, mitered corners.

.2 Surface mount.

.3 Size to meet air flow requirements as shown on the drawings.

.4 Single deflection with and opposed blade damper.

.5 Acceptable product: Nailor 51SH-O.

2.6 RETURN AIR GRILLE

.1 Aluminum construction, mitered corners.

.2 Surface mount.

.3 Size to meet air flow requirements as shown on the drawings.

.4 Single deflection with and opposed blade damper.

.5 Acceptable product: Nailor 51EC45-O, Type S.

3 Execution.

3.1 DEMOLITION

.1 All unused HVAC equipment, duct, or vents that is no longer in service shall be removed and disposed of by the Contractor.

3.2 INSTALLATION

.1 Refer to and comply with Section 23 05 01 Heating and Ventilation General

END OF SECTION

1 General

1.1 INTENT

.1 This section refers to the heating and ventilation ductwork insulation.

1.2 CONDITIONS AND DEFINITIONS

.1 For the purposes of this section, the following definitions apply:
- .1 “k” Value: thermal conductivity of insulating material per unit if thickness (W/m ºC).
- .2 Hot duct: ductwork conveying air used for heating whose average temperature is greater than 38ºC.
- .3 Cold duct: ductwork conveying air used for air conditioning whose average temperature is less than 15ºC.

1.3 SUBMITTALS

.1 Submit an insulation schedule to define the scope of duct insulation and include the following information:
- .1 Material
- .2 “k” Value
- .3 Thickness
- .4 Finish

1.4 FLAME/SMOKE DEVELOPMENT RATINGS

.1 Duct insulation, vapour barrier facings, tapes and adhesives shall have minimum flame spread ratings less than or equal to 25 and a maximum smoke developed less than or equal to 50, when tested in accordance with CAN/ULC-S102, NFPA 255 or ASTM E84.

.2 Insulating materials and accessories must withstand service temperatures without smouldering, glowing, smoking or flaming when tested in accordance with ASTM C411.

2 Products

2.1 INSULATION MATERIALS

.1 Mineral fibre insulation for hot and cold ducts:
- .1 Material: flexible mineral fibre blanket insulation to CAN/CGSB-51.11 and CGSB 51-GP-52.
- .2 “k” Value: maximum 0.038 W/m ºC at 24ºC.
- .3 Service temperature: -40ºC to 65ºC.
- .4 Jacket: factory applied reinforced aluminum foil barrier to CGSB 51-GP-52M.

.2 Mineral fibreboard insulation for acoustic lined dusts:
- .1 Material: rigid mineral fibreboard to CAN/CGSB-51.10
- .2 “k” Value: maximum 0.035 W/m ºC at 24ºC.
- .3 Service temperature: -40ºC to 65ºC.
- .4 Surface finish: coated to prevent erosion on all exposed surfaces. Roughness is not to exceed 0.58 mm.
- .5 Acoustic attenuation: noise reduction coefficient (NRC) of 0.8 for 25 mm thickness using ASTM CA23 test method with F-25 mounting.

.3 Mineral fibre insulation for breeching:
  .1 Flexible mineral fibre blanket to CAN/CGSB-51.11.
  .2 “k” Value: maximum 0.036 W/m ºC at 24ºC.
  .3 Service temperature: 65ºC to 450ºC.

2.2 ACCESSORRIES

.1 FSK joint tape: 100 mm wide with vapour barrier with laminated aluminum foil, glass fibre scrim and paper with pressure sensitive self-adhesive:

.2 ASJ tape: vapour resistant tape with all service jacket material and pressure sensitive self-adhesive.

.3 Contact adhesive: quick setting, adhesive to adhere mineral fibre/fibreboard insulation to ducts.

.4 Lap seal adhesive: quick setting adhesive for joints and lap sealing of vapour barriers.

.5 Canvas adhesive: washable adhesive for cementing canvas jacket to duct insulation.

.6 Pins: welding pins 4 mm diameter shaft with 35 mm diameter head for installation through the insulation. Length to suit thickness of insulation with 32 mm square nylon retaining clips.

2.3 RECOVERY MATERIALS

.1 Canvas: 220 g/m² plain weave cotton fabric with dilute fire retardant lagging adhesive, ULC listed.

2.4 MANUFACTURERS

.1 Acceptable Manufacturers
  .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
    .1 Fiberglas,
    .2 Manson,
    .3 Owens Corning,
    .4 Knauf,
    .5 Certainteed Corp.
  .2 Acceptable Manufacturers are selected based upon the following criteria
    .1 Performance / compatibility of supplied equipment
    .2 Historical level of service provided by the manufacturer
    .3 Historical level of service provided by the local distributors / representatives
    .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

3 Execution

3.1 DEMOLITION

.1 All unused HVAC equipment, duct, or vents that is no longer in service shall be removed and disposed of by the Contractor.

3.2 INSTALLATION

.1 Refer to and comply with Section 23 05 01 Heating and Ventilation General.

.2 General
- .1 Dimensions shown on drawings are clear inside measurement regardless of insulation placement. Fabricate ducts accordingly.
- .2 Apply insulation after required duct system tests have been completed and approved by the Owner's Representative.
- .3 Apply insulating materials only to duct surfaces that are clean and dry.
- .4 Install insulation continuous on ductwork through walls and floors, except where required for fire separation.
- .5 Install insulation continuous over full length of duct and fittings without penetration of hangers, standing duct seams and without interruptions at sleeves.
- .6 Locate longitudinal seams in the least visible location.
- .7 Install insulation at ambient temperatures within acceptable ratings for tapes, sealants and adhesives.
- .8 Recover exposed insulated duct work with canvas.

.3 Duct Insulation Schedule
- .1 Insulate supply ductwork in its entirety with 25 mm thickness insulation unless specified otherwise:
  - .1 Exhaust and relief plenums on all air systems: 25 mm thick
  - .2 Ducts within 3 m of exhaust discharge to outdoors: 25 mm thick
  - .3 Outside air intake ducts and/or plenums to all air systems: 50 mm thick
  - .4 Combustion air intake ducts: 50 mm thick
  - .5 Sound traps: 50 mm thick
  - .6 Where shown on drawings: 25 mm thick
- .2 Do not insulate the following ducts with insulation on exterior of ducts:
  - .1 Ducts with acoustic lining
  - .2 Bevel corners at joints and butt together. Brush coat all cut edges with lap seal adhesive. Install acoustic gauze over all cut corners and joints and brush coat with lap seal adhesive.
  - .3 Secure acoustic lining on medium and high velocity ductwork and ducts with galvanized perforated metal where air velocities exceed 10 m/s.

END OF SECTION

1 General

1.1 INTENT

.1 This section refers to the heating and ventilation ductwork.

1.2 CONDITIONS AND DEFINITIONS

.1 Low pressure: Static pressure in duct less than 0.5 kPa and velocity less than 10 m/s.

.2 Medium pressure: Static pressure in duct less than 1.5 kPa and velocity more than 10 m/s.

.3 Duct sizes: Inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

2 Products

2.1 GENERAL

.1 Construct, support and install all ductwork according to ASHRAE guides and SMACNA duct manuals.

.2 Galvanized steel ducts: Galvanized steel, lock forming quality, with galvanized coating to ASTM A525 G90 designations on both sides.

.3 Fasteners: Use rivets and bolts throughout; sheet metal screws are accepted on low pressure ducts

.4 All joints and duct connections for low and high velocity ductwork shall be sealed or caulked with an approved sealant and taped as ducts are being assembled to ensure airtight fittings. Sealant shall be water resistant, fire resistant, and compatible with mating materials.

.5 Flexible ducts: Corrugated aluminum or fabric supported by helically wound steel wire or flat steel strips fastened by galvanized bands with tightening screws. Bridge each flexible connection with No. 8 AWG base copper wire conductor.

2.2 DUCTWORK SUPPORT

.1 Support all ductwork to eliminate all vibrations, sagging and swaying using hangers at 2.4 m centres for ducts up to 450 mm wide and at 1.2 m centres for ducts wider than 450 mm.

.2 Hangers: galvanized steel angle with galvanized steel rods as follows:

Duct size (mm)	Angle size (mm)	Rod size (mm)
Up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.3 Support vertical ducts at each floor level with angle iron girth brackets of approved size. Securely attach these brackets to angle framing to be anchored in the floor at openings using galvanized bolts and nuts.

.4 Provide approved inserts for hangers where ducts run under concrete slabs or structural metal decks.

2.3 LOW PRESSURE DUCT THICKNESSES (MINIMUM)

.1 Rectangular ducts:

Maximum width (mm)	Thickness (mm)
Up to 300	0.6
330 to 750	0.8
790 to 1370	0.8
1400 to 2130	1.0
2160 and over	1.2

.2 Round ducts:

Duct diameter (mm)	Thickness (mm)
Up to 330	0.6
350 to 550	0.8
580 to 910	1.0
1300 to 1520	1.2
1550 to 2130	1.6

2.4 MEDIUM PRESSURE DUCT THICKNESS

.1 Rectangular ducts:

Maximum width (mm)	Thickness (mm)
Up to 460	0.8
480 to 1220	0.8
1250 to 1830	1.0
1850 to 2440	1.2
2460 and over	1.6

2.5 PLENUM GAUGES

.1 Fabricate fan plenums downstream of fans in accordance with duct gauges.

.2 Fabricate plenums upstream of fan between apparatus of 1.6 mm.

.3 Fabricate plenums upstream of filters of 1.2 mm.

2.6 ACCESS DOORS

.1 General

.1 Non-insulated sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.8 mm thick, complete with sheet metal angle frame.

.2 Insulated sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.8 mm thick, complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.2 Provide neoprene or foam rubber gaskets on all access doors.

.3 Hardware:
.1 Up to 300 x 300 mm: 2 sash locks.
.2 301 to 450 mm: 4 sash locks.
.3 451 to 1000 mm: piano hinge and a minimum of 2 sash locks.
.4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.

2.7 TURNING VANES

.1 Factory or shop fabricated single or double thickness to SMACNA recommendations.

3 Execution

3.1 DEMOLITION

.1 All unused HVAC equipment, duct, or vents that is no longer in service shall be removed and disposed of by the Contractor.

3.2 INSTALLATION

.1 Refer to and comply with Section 23 05 01 Heating and Ventilation General.

.2 Fabricate and install ductwork in accordance with SMACNA duct manuals, ASHRAE and Alberta Building Code requirements and the requirements specified in this section.

.3 Complete metal duct conduits unique with no single partition between ducts. Where width of duct exceeds 450 mm cross break for rigidity. Open corners are not acceptable.

.4 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior. Alternately, jointing systems for round and rectangular ducts as manufactured by “Ductmate” (or equal) may be used subject to conformance with the manufacturer’s recommended installation procedures. Jointing is acceptable on systems up to 2500 Pa.

.5 Construct tees, bends and elbows with radius not less than 1.5 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide approved type air foil turning vanes. Where acoustic lining is provided, provide turning vanes of perforated metal type with fibreglass inside.

.6 Increase duct sizes gradually, not exceeding 30 degree divergence wherever possible. Maximum divergence upstream of equipment to be 30 degrees and 45 degrees convergence downstream.

.7 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and reinforced so as not to breathe, rattle, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

.8 Fabricate plenums and casings to configurations shown on drawings. Construct plenums of galvanized panels joined standing seams on outside of casing riveted or bolted on approximately 300 mm centres. Reinforce with suitable angles and provide diagonal bracing as required. Tightly fit at apparatus and caulk with sealant.

.9 Reinforce door frames with angle iron tied to horizontal and vertical plenum supporting angles. Install hinged access doors where shown, specified or where required for access to equipment for cleaning and inspection.

.10 Provide balancing dampers as shown and as required for proper air balancing.

.11 Piping or conduit passing through ductwork is not permitted.

.12 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide Pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install a metal ring inside insulation material.

.13 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.14 Provide floor drains in fresh air with deep seal traps.

.15 Set plenum doors 150 to 300 mm above floor. Arrange door swings so that fan static holds door in closed position.

.16 Install duct inlets to terminal units using round sheet metal duct; diameter equal to the inlet diameter of the terminal unit. Provide a straight duct at terminal inlet not less than four (4) duct diameters.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 Ductwork shall be cleaned just prior to turnover to the Owner.

3.4 TESTING AND VERIFICATION

.1 Provide a balanced system, engage the services of a balancing agency to balance the air systems and provide a report. Report is to be included in the O&M manual.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Supplemental Conditions:	Section 00 73 00
.2	General Contract Requirements:	Division 01
.3	Submittal Procedures:	Section 01-33-00
.4	Execution and Closeout Requirements:	Section 01-70-00
.5	Operation and Maintenance Data:	Section 01-78-23
.6	Electrical Installations in Zone Classified Hazardous Locations:	Section 26-05-02
.7	Cable Trays, Wireways, Surface Raceways:	Section 26-05-36

1.3 Project Scope Of Work (Summary)

.1 The following summary outlines the key work items that define the main electrical and controls scope of work for this project.

- .1 Supply of all electrical, instrumentation, controls, and communications equipment (except where specifically noted to be provided by others) and all related materials as outlined in the drawings and this specification for the new Hearthstone Sanitary Lift Station in Strathcona County.
- .2 Complete installation of all electrical, instrumentation, controls, and communications equipment and related materials at the new Hearthstone Sanitary Lift Station.
- .3 An overview of the general work items the lift station is listed herein:
  - .1 Incoming Utility Service (coordination with Fortis Alberta)
  - .2 Electrical (600V) power distribution system, including:
    - .1 Main service disconnect and utility metering provisions
    - .2 Motor Control Centre (MCC)
    - .3 Standby Generator
    - .4 Automatic Transfer Switch (ATS)
    - .5 Transformer and panelboard for LV building loads (i.e., lighting, receptacles, misc.)
    - .6 System ground grid and overall grounding/bonding of complete facility
  - .3 Variable Frequency Drives (VFDs) for speed control of pumps
  - .4 Active Harmonic Filter (AHF) for harmonic mitigation
  - .5 PLC Control System, control and communications cabinet
  - .6 Instrumentation including:
    - .1 Flow measurement
    - .2 Level measurement and indication

.3 Pressure measurement and indication

.4 Door/hatch switches for entry detection

.5 Fixed gas detection

.7 Lighting systems (interior/exterior, site, dry-well, wet-well)

.8 Cabletray, conduit, and wiring systems.

.9 Miscellaneous devices (e.g., light switches, receptacles, data outlets, etc.)

.10 Visual alarm indication (gas detection, hvac trouble/failure).

.11 Connections to process equipment (e.g., pump motors, blower heater, etc.).

.12 Connections to building service equipment (e.g., HVAC, hoist, etc.)

.13 Systems Integration

.2 Other activities expected to be completed by the Contractor:

.1 Clean all areas of work and remove all debris on a daily basis. Complete thorough cleaning when construction work is complete.

.2 Coordinate the commissioning with Owner's Staff.

.3 Application of settings to all electrical protective devices and installation of Arc Flash Level Warning Labels to all equipment. Settings and labels to be provided to the Contractor by the Owner's Representative.

.4 Make wiring connections to all equipment provided by other divisions as required, including but not limited to; process motors, HVAC equipment, motorized valves, instruments, vendor packaged equipment skids, and vendor control panels.

.5 Restore all excavated grassed areas. Provide a 150mm layer of black loam topsoil. Apply lawn seed by using hydro-seeding.

.3 Construction Notes:

.1 Contractor to provide adequate temporary power, lighting and heating for the building and site throughout construction.

.2 Wiring throughout the inside of the building is to be primary via TECK cable in tray. Wiring down to wall mounted devices shall be via instrument tray (see Section 26-05-36 Cable Trays, Wireways, Surface Raceways) or other means as indicated in detail within the drawings.

.4 The summary provided above is provided only as introduction to supplement the project documentation (i.e., drawings and specifications); it does not necessarily include all items of work, and it is not intended as an exhaustive list of all work to be completed.

.5 Any items that are omitted from this summary, but are outlined elsewhere within the project documentation, are nonetheless expected to be included in the Contractor's scope of work as though it were listed in the summary.

.6 In the event of discrepancy or conflict between the work items listed in the above summary, as compared to detail listed elsewhere in the project documentation, the detail listed elsewhere in the project documentation shall take precedence.

1.4 Shop Drawings, Product Data And Samples

.1 Submit shop drawings, product data and samples as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials. Include data on manufacturer's recommended environmental conditions for equipment affected by temperature and humidity.

.2 Provide wiring, single line and schematic diagrams for electrical control systems and where otherwise applicable. Include wiring drawings or diagrams showing interconnection among work of different Sections.

.3 Comply with Section 01 33 00 – Submittal Procedures.

1.5 Project Record Drawings

.1 Record actual locations of all pull boxes, feeders, electrical equipment, conduit and wire. Note all sizes.

.2 Record any changes to branch circuit designations.

.3 Record changes daily to maintain accuracy.

.4 Refer to Section 01 70 00 – Execution and Closeout Requirements.

1.6 Regulatory Requirements

.1 Comply with Electrical Protection Act of Alberta and rules and regulations made pursuant thereto, including the Canadian Electrical Code.

.2 Unless otherwise indicated, all references in the Contract Documents to "Canadian Electrical Code" or "CEC" shall mean the latest edition of the Canadian Electrical Code, Part I, CSA C22.1 and the variations made thereto by Alberta regulation, which are in force.

.3 All electrical products shall be approved by the Canadian Standards Association (CSA) and bear the CSA label. Alternatively, where a product does not bear a CSA label, it shall be approved in writing by the authority having jurisdiction.

.4 Submit to authority having jurisdiction, inspection and utility company, necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees. The Owner's Representative has not submitted drawings to inspection and supply authorities.

.5 Submit to Owner's Representative, copy of electrical permit obtained from authority having jurisdiction.

.6 Provide and pay for required permits.

1.7 Warranty

.1 Refer to and comply with Section 00 73 00 (Supplemental Conditions)

1.8 Certificates

.1 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.

1.9 Reference Documents

.1 Comply with applicable standards of following organizations:

.1 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.2 National Electrical Manufacturers Association (NEMA).

.3 Institute of Electrical and Electronic Engineers (IEEE).

.4 American National Standards Institute (ANSI).

.2 Follow all requirements as generally laid out in the following Strathcona County standards and guidelines which can be provided to the Contractor upon request to the Owner's Representative:

.1 Strathcona County Design and Construction Standards (Jan 2021 version or latest)

.2 Strathcona County Lift Station Standards – As a basis for Design and Construction Standards (Jun 2021 version or latest).

1.10 Cleaning

.1 Do the following prior to functional completion of the work, as required to remove all construction dust and debris:

.1 Clean out all cabinets and enclosures with vacuum or compressed air.

.2 Wipe all insulators with clean, dry rags. Wipe all equipment including but not limited to MCC's, VFD's, panels, transformers, etc.

.3 Clean all luminaires, with vacuum or clean dry rags.

1.11 Site Examination

.1 Examine the site of work and become familiar with all features and characteristics affecting this work before submitting tender.

.2 No additional compensation will be given for extra work due to existing conditions, which such examination should have disclosed.

.3 Report any unsatisfactory conditions prior to tendering which may adversely affect the proper completion of this work.

1.12 Coordination With Other Divisions

.1 Examine the drawings and specifications of all divisions and become fully familiar with their work. Before commencing the work, obtain a ruling if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.

.2 Fully understand the functions of the systems specified and have no doubts with regard to the extent of the contract.

.3 Coordinate with all divisions installing equipment and services and ensure that there are no conflicts.

.4 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

.5 Lay out the work and arrange the equipment with due regard to architectural, structural and mechanical features. Architectural and structural drawings take precedence over electrical drawings regarding location of walls, doors, and equipment.

.6 Do not cut structural members without approval.

.7 Examine previously constructed work and identify any conditions, which prejudice the proper completion of this Work.

1.13 Location Of Outlets And Luminaries

.1 Electrical drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.

.2 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised up to 3 meters to suit construction and equipment arrangements without additional cost to the Owner, provided that installation has not been completed.

.3 Maintain luminaire locations wherever possible. Notify the Owner's Representative of conflicts with other services.

.4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

1.14 Area Classification Requirements

.1 All work within zone classified hazardous locations shall be completed in accordance with the requirements details in Section 18 of the CEC as well as National Fire Protection Agency Standard 820 (NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities).

.2 Refer to requirements of Section 26 05 02 – Electrical Installations in Zone Classified Hazardous Locations.

1.15 Separation Of Services

.1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.

.2 Contact between dissimilar metals, such as copper and aluminum, in a damp or wet location is not permitted.

.3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Owner's Representative and the ceiling installer and approved clips, or hangers are used.

1.16 Sealing Of Wall And Floor Openings

.1 All conduit and cable entries through outside walls of buildings through partition walls separating electrical rooms from other areas, through fire separations and through floors above grade shall be sealed to prevent passage of moisture, dust gases, flame or to maintain pressurization.

.2 Openings shall be sealed when all wiring entries shown on the drawings have been completed.

.3 Seal all penetrations through fire rated walls, floors, and ceilings with fire-stopping. Ensure that the integrity of the fire rated element is maintained.

.4 Where penetrations are made for electrical cable and equipment through fire rated separations (e.g., walls, floors, ceilings, etc.) the remaining void is to be sealed with fire-stopping material to ensure that the integrity of the fire rated element is maintained.

.1 Sealing material shall be CSA/ULC approved fire resistant and shall not contain any compounds which will chemically affect the wiring jacket or insulating materials.

.2 Use 3M “Fire Barrier” series or equivalent as manufactured by Hilti, or Specified Technologies Inc. (STI).

.3 Watertight silicone firestop sealant is generally to be used in remaining voids resulting from cable/conduit penetrations.

.4 Preformed firestop blocks are suitable for use on larger voids resulting from cable tray penetrations and where multiple cable/conduit penetrations are located close together.

.5 Install all fire-stopping material in accordance with manufacturers installation instructions.

1.17 Sprinkler Proof Equipment

.1 Electrical equipment installed where sprinklers are also installed shall be constructed so that water from the sprinkler heads shall not impair the effectiveness of the equipment.

.2 A separate and complete roof shall be provided on free standing or surface mounted equipment. An overhang at the front, rear and sides shall prevent the entrance of water either at the top or through project faceplates, meters, etc.

.3 Where openings are required in the roofs or sides for incoming and outgoing conduits and cables, removable gasketted plates shall be provided and the conduits and cables shall be installed using waterproof fittings. The plates are to be grounded by a separate copper strap to the equipment.

.4 Distribution, power and lighting panelboards and switchboards shall be completed with gasketted covers and doors.

1.18 Housekeeping Pads

.1 All floor mounted electrical equipment installed by this division shall be mounted on concrete housekeeping pads. Pads to have reinforcing wire mesh or rebar and shall be secured to base floor slab.

.2 Structural drawings and specifications shall be followed for construction of concrete pads.

.3 The utility transformer pad shall be pre-cast as required and shall adhere to the standards of the utility supply company.

1.19 Sleeves

.1 Provide sleeves of PVC conduit or as specified otherwise of ample size to accommodate conduits and cables passing through walls, partitions, ceilings, floors, etc.

.2 For wall partitions and ceilings, the ends shall be flush with the finish on both sides but for floors they shall extend 100 mm above finished floor level.

.3 The space between the sleeve and the conduit shall be filled with silicone foam for fire stop and caulked around the top and bottom with approved permanently resilient, non-flammable and weatherproof silicone base compound and ensure that the seal is compatible with the floor and ceiling finishes.

.4 Locate and position sleeves exactly prior to construction of walls and floors.

1.20 Touchup

.1 Touch-up with matching paint any scratches on equipment.

1.21 Maintenance Manuals

.1 Provide four (4) hard covered, 3-ring binders complete with operations and maintenance data.

.1 Provide an electronic copy of all operations and maintenance data, in PDF file format, with sections appropriately bookmarked.

.2 The information provided in the maintenance manuals shall at a minimum include the following:

.1 Shop drawings,
.2 Technical data,
.3 Catalog data,
.4 Operator and maintenance details,
.5 Illustration of control logic,
.6 Description of system operations,
.7 Governing criteria,
.8 Critical conditions,
.9 Table of monitored conditions,
.10 Settings reference for all programmable equipment,
.11 Commissioning reports,
.12 Record of serial numbers for all equipment,
.13 Electronic copy of all programming files,

.3 Provide suitable labelling.

.4 Comply with Section 01-78-23 – Operation and Maintenance Data

1.22 Examination Prior to Cutting, Coring, or Similar Penetrations

.1 Perform non-destructive, investigative survey with radar, x-ray, sonar, or other appropriate means prior to any and all penetrating operations on floor slab, wall, structural member, or similar building element that may contain reinforcement or building systems susceptible to damage. This includes, but is not limited to, coring, cutting, boring, depth fastening, etc.

.2 All openings to be neatly cored or cut. When water is used, provide drain pan to catch water.

.3 Support core cut-out prior to completing core.

.4 Do not cut/core through rebar

1.23 Demolition

.1 Remove existing equipment and wiring for demolished equipment or equipment noted to be removed and as required to facilitate the work.

.2 Repair any damaged wiring (caused by demolition) that is required to maintain service to other systems or equipment. Advise the Owner and/or Owner’s Representative and repair as required.

.3 Remove demolished materials form site unless otherwise noted.

Part 2 PRODUCTS

2.1 Not Used.

Part 3 EXECUTION

3.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26 00 10

1.3 Designated Hazardous Location Area Classifications

.1 In accordance with NFPA 820 (Standard for Fire Protection in Wastewater Treatment and Collection Facilities), the Hazardous Location (HazLoc) area classification boundaries at the Lift Station is as follows:

.2 Areas throughout the facility designated as Hazardous Locations (HazLoc) are classified as follows:

.1 Wet Well and Inlet vault is designated Class 1, Zone 2, Category 2 corrosive

.1 Based on minimum continuous ventilation of 12 air changes per hour.

1.4 Wiring Method

.1 All wiring installed within designated HazLoc areas must be suitably rated to comply with the noted zone classification.

.2 Wiring shall generally consist of HL rated TECK cable with approved gland type connectors rated for the classification of the area.

.3 All boxes, fittings, covers, devices, etc. (except as noted otherwise) shall be cast aluminum construction with threaded hubs.

.4 Install seals as required by code.

.5 For control stations installed in zone classified hazardous locations, control devices (selector switches, pilot lights, pushbuttons, contact blocks, etc.) consisting of integrally sealed units can be utilized thereby eliminating the requirement for external seals as required by code (CEC). Any control stations/devices provided with integral seals must be suitably rated to meet the classification of the space in which the unit is being installed.

.6 Rigid aluminum threaded conduit may be used where appropriate.

.7 Ensure grounding and bonding is provided for all non-current carrying metal parts of electrical equipment.

.8 Where classified fixtures are suspended, utilize approved stem flexible fittings.

Part 2 PRODUCTS

2.1 Equipment

.1 All electrical equipment installed within designated HazLoc areas must be suitably rated to comply with the noted zone classification.

.2 See drawings and other specification sections for specified materials and equipment.

Part 3 EXECUTION

3.1 Installation

.1 Installation to be completed as noted on drawings and in other specification sections.

.2 All work within zone classified hazardous locations shall be completed in accordance with the requirements detailed in Section 18 of the CEC as well as National Fire Protection Agency Standard 820 (NFPA 820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities).

.3 Refer to drawings identifying boundaries of hazardous area classification locations.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

Part 2 PRODUCTS

2.1 Building Wiring

.1 Building Wiring: to CSA C22.2 No. 75-M1983 and as follows:

- .1 Conductors: solid copper for No. 10 AWG and smaller, stranded copper for No. 8 AWG and larger, or for connections to motors, actuators and other instrumentation and control equipment.
- .2 Insulation: RW90 X-link. Except where specifically indicated otherwise.
- .3 Insulation Rating: 1000V for 600-volt circuits
- .4 Insulation Rating: 600 V for 120/208-volt circuits.

2.2 Cables

.1 TECK-90 Cable

- .1 For use in power and instrumentation/control circuits
- .2 Manufactured to CSA C22.2 No. 131 with flame spread characteristics per CSA C22.2 #0.3-M1985.
- .3 Constructed with features as follows:
  - .1 Conductor: Copper, stranded.
  - .2 Insulation: RW90 X-link.
  - .3 Rating: 1000 V for 600-volt circuits, 600 V for 120/208-volt circuits.
  - .4 Size: As shown on drawings.
  - .5 Configuration: As indicated on drawings.
  - .6 Armour: Aluminum interlocking.
  - .7 CSA - PVC jacket, HL, FT4 rated.

.2 Armoured Instrumentation Cable

- .1 For use in instrumentation and control circuits only where noted.
- .2 Multi-conductor, multi-pair, or multi-triad as indicated on the drawings
- .3 Constructed with features as follows:
  - .1 Conductor: Copper, stranded.
  - .2 Insulation: Cross-linked polyethylene (XLPE)
  - .3 Rating: 300 V

.4 Size: As shown on drawings.

.5 Configuration: As indicated on drawings, where shielded twisted pairs (STP) are indicated on drawings, provide with individual and overall shield

.6 Armour: Aluminum interlocked armour (AIA).

.7 CSA - PVC jacket, flame test rating.

2.3 Connectors

.1 Provide factory fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated.

.2 Use aluminum connectors for cables with aluminum armour.

.3 Armoured cable connectors to be compression gland sealing type.

Part 3 EXECUTION

3.1 Wiring, General

.1 Splice only in junction or outlet boxes.

.2 Conductor length for parallel circuits shall be identical.

.3 Neatly train and lace conductors inside cabinets, equipment and panelboard using nylon tie-wrap.

.4 Cables outdoors shall enter enclosures from the bottom.

.5 All small stranded wire for control circuits, etc. shall be terminated using a crimped Stak-On type wire lug.

.6 Swab the raceway system before installing wiring.

.7 Use pulling lubricant for conductors No. 4 AWG and larger.

.8 Use pressure connectors with insulated covers for copper wire splices and taps, No. 8 AWG and smaller.

.9 Use insulated spring wire twist-on connectors with plastic caps for conductors No. 10 AWG and smaller for lighting, small power and control wiring.

.10 Make motor connections (No. 10 AWG & larger) using short-barrel one-hole ring compression lugs. Bolt the two lugs together and insulate the connection with a removable rubber boot. Do not use split bolts.

.11 Splices for No. 8 AWG and larger shall, except as noted, be made with compression connectors, such as Burndy ‘Hylug’. Use anti-oxidizing compound.

.12 Where applicable, use specifically designed TECK cable for VFD to motor runs such as Alcatel Type Drive Rx.

3.2 Wire Size Schedule

.1 Lighting and Power Circuits: No. 12 AWG minimum or as noted.

.2 Instrumentation Circuits: As shown on drawings.

.3 Feeder Circuits: As indicated on drawings or in schedules.

.4 Control Circuits: No. 16 AWG stranded.

3.3 Branch Circuit Lengths

.1 No. 12 AWG, up to 30m at 120V and up to 60m at 347V or as specifically noted.

.2 No. 10 AWG, over 30m at 120V and over 60m at 347V or as specifically noted.

3.4 Luminaire Connections

.1 Connect recessed luminaires with approximate 2m of 2c#12 RW 90 BX cable.

.2 Connect suspended luminaires with 2c#12 RW90 in flexible cable.

3.5 Testing

.1 Prior to energizing cables, perform testing as specified in Section 26-08-10 (Electrical Starting and Testing – General Requirements).

3.6 Wiring Method

.1 Generally, all wiring for the project is to utilize TECK and armoured instrumentation cables supported by cable tray however conduit and wire shall be used selectively where specifically indicated.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Electrical General Requirements:	Section 26-00-10
.2	Wires and Cables (0-1000V)	Section 26-05-21

Part 2 PRODUCTS

2.1 Materials

.1 Grounding and Bonding Equipment:

- .1 Ground Rods: 19 mm x 3 m copper clad, (or as noted elsewhere).
- .2 Ground Conductors: as specified in Section 26-05-21 – Wires and Cables (0-1000V).

.2 Ground Grid: see drawings for details.

Part 3 EXECUTION

3.1 Installation

.1 Comply with requirements of Canadian Electrical Code.

.2 Install complete permanent grounding system including electrodes, conductors, connectors, and accessories. All conductors to be green insulated RW90 except the use of bare stranded conductor in the ground.

.3 Protect exposed ground conductors from mechanical injury.

.4 Make cable-to-cable connections, using compression connectors such as BURNDY ‘HYGROUND’.

.5 Use mechanical connectors for ground connection to equipment provided with lugs. Use Burndy type GP or GK compression connector for connecting wire to ground rods.

.6 Do not solder joints. If not noted specifically otherwise, use mechanical connectors approved for the purpose.

.7 Install insulated bonding wire in flexible metal conduit connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.

.8 Install separate green insulated ground conductor in all conduit runs.

.9 Ground grid and wires to be a minimum of 600 mm below finished grade.

3.2 System Grounding

.1 Provide conductor from ground grid to system neutral point (where applicable).

3.3 Equipment Grounding/Bonding

.1 Install a green insulated conductor in all feeders, receptacle and equipment circuits.

.2 Install grounding/bonding for non-electrical equipment as noted in section 10 of CEC.

.3 Bond transformers, motor frames, panels, MCC's, metallic raceways, metallic piping, structural steel, and cable tray.

.4 Bolt bonding cable to structural steel with compression 2-hole long barrel lug (when applicable).

.5 Provide mechanical protection for bonding and grounding cables where prone to mechanical damage.

.6 Bond building structural steel columns using a 3/0 AWG conductor (when applicable).

.7 All bonding conductors to be copper with green coloured type RW90 insulation.

3.4 Testing

.1 Perform all testing as specified in Section 26-08-10 (Electrical Starting and Testing – General Requirements).

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.1 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

Part 2 PRODUCTS

2.1 Supporting Devices

.1 Provide metal brackets, frames, hinges, clamps and related types of supporting devices and support systems channels adequate for weight of equipment and raceways, including wiring, which they carry. All materials to be galvanized steel.

.2 Straps: Galvanized steel.

.3 Channels: 42 x 42 mm galvanized steel and as specifically sized.

.4 Rod Hangers: 9 mm all-thread rod, non-corrosive type (larger as required).

.5 Inserts: Flush mount internal thread anchor.

.6 As manufactured by Thomas & Betts, B-Line, Unistrut.

.7 All fasteners, screws, bolts, washers, inserts, tap screws, etc. to be stainless steel non-corrosive type.

Part 3 EXECUTION

3.1 Installation

.1 Install supporting devices to maintain headroom, neat mechanical appearance and to support equipment loads required.

.2 Except where otherwise indicated, support equipment, conduit and cables using clips, spring-loaded bolts, or cable clamps designed as accessories to base channel members. Channels to be surface mounted or trapeze hung as required.

.3 Support exposed conduit and conduit installed in space above suspended ceilings and in crawl spaces using hangers, clamps or clips. Support conduit on each side of bends and on spacing in accordance with Canadian Electrical Code.

.4 Where three (3) or more conduits run parallel, install conduit on conduit racks. Size conduit racks to provide 50% spare capacity.

.5 Support riser conduit at each floor level with clamp hangers.

.6 Do not fasten supports to piping, ductwork, mechanical equipment or conduit.

.7 Do not use shot driven pins.

.8 Install surface mounted cabinets and panelboards with minimum or four bolt anchors.

.9 Coordinate installation of all conduit and cable between electrical and instrumentation subtrades to ensure that a uniform looking installation is achieved, with specified spare capacities throughout.

.10 Increase channel size and hanger rod to suit specific loads.

.11 When drilling and attaching onto galvanized steel members, touch-up hole and joint with galvanizing steel paint.

.12 Nylon tie-wraps to be heavy-duty, UV resistant type, with metal inserts.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

Part 2 PRODUCTS

2.1 Concealed Boxes

.1 Galvanized pressed sheet steel c/w conduit knockouts.

.2 Minimum 50 mm deep.

.3 100 mm square complete with plaster ring in one (1) or two (2) gangs.

.4 Used for mounting of wiring devices.

.5 For larger boxes use Type GSB.

.6 In masonry use deep Type MBD boxes.

.7 As manufactured by Temco, Iberville, Commander.

2.2 Surface Boxes (Interior & Exterior)

.1 Ferrous or aluminum for wiring devices complete with threaded conduit hubs.

.2 Crouse-Hinds condulet cast boxes Type FS/FD, etc.

.3 Number of gangs as required.

.4 Box to have cast mounting ears (one-piece box)

.5 Device covers to be a matching cast aluminum unit.

.6 As manufactured by Crouse-Hinds, Killark, Appleton.

2.3 Junction Boxes (Exterior)

.1 Sized as noted.

.2 Non-corrosive, dust tight, watertight.

.3 NEMA 4X rating (unless specifically noted otherwise).

.4 Hinged gasketed cover with lockable handle.

.5 Constructed of stainless-steel unless specifically noted otherwise.

.6 As manufactured by Hammond, Hoffman.

2.4 Junction Boxes (Interior)

.1 Non-corrosive, dust tight, watertight.

.2 NEMA 12 (unless specifically noted otherwise).

.3 Hinged gasketed cover with key lockable handle.

.4 Constructed of sheet steel unless specifically noted otherwise.

.5 As manufactured by Hammond, Hoffman.

.6 For small junction boxes use either:

.1 Square sheet steel boxes with hinged covers and quick release latches

.2 Square PVC boxes with screw-on covers.

2.5 Location Of Wall Outlet Boxes

.1 Outlets are indicated on drawings schematically. Consider locations indicated as approximate. Verify locations prior to rough-in.

.2 Confirm size and location of equipment supplied and installed under other sections, prior to rough-in.

.3 Except where otherwise indicated, mount boxes at following heights:

.1	Local Switches:		1200mm
.2	Receptacles:		
	.1	General	600mm
	.2	Above Counters	150mm
	.3	Above Baseboard Heaters	200mm
.3	Telephone Outlets:		
	.1	General	300mm
	.2	Wall Mounted Telephone	1400mm
.4	Fire Alarm:		
	.1	Manual Break-glass Stations	1400mm
	.2	Alarm Bells or Horns	3000mm

Part 3 EXECUTION

3.1 Installation

.1 Measure mounting height from finished floor to centre line of device.

.2 The Owner and/or the Owner's Representative reserves the right to change location of outlet prior to installation with no charge in Contract Price, provided that distance does not exceed 3 m from originally indicated location.

.3 Except where otherwise indicated, install boxes for vertical mounting of devices.

.4 Support boxes independent from conduit. For cavity walls attach to metal stud with Caddy "quick mount box supports".

.5 Install air/vapour hats around electrical outlets located on cold walls/ceilings or where building vapour barrier is specifically noted. Use formed shrouds consisting of 0.04 mm thick polyethylene with 25mm flanges suitably sized for each outlet. Maintain wall insulation.

.6 Size boxes to accommodate number of conduits, cables, and conductors all in compliance to code.

.7 Neatly drill knockouts into enclosures. For exterior enclosures, enter at bottom.

.8 Connect ground wire to ground stud in each box or cabinet.

.9 Install pull and junction boxes as noted and as required.

.10 Do not use cast octagon boxes as J-boxes.

.11 Unless being installed to replace existing, junction and pull boxes are not permitted to be installed below grade (i.e. in wet well or dry well) and shall be installed above grade only.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

1.3 Coordination

.1 Coordinate with other work including wire and cable, boxes and fittings and panel work, as necessary to interface installation of conduit with other work.

Part 2 PRODUCTS

2.1 Conduit - General

.1 Provide conduit of types and sizes indicated. Refer to the ‘Conduit Installation Schedule’ at end of this Section.

.2 Where sizes are not indicated, select proper sizes to suit intended use, fulfill wiring requirements, and comply with Canadian Electrical Code (CEC).

2.2 Metal Conduit

.1 Rigid Metal Conduit:

- .1 Fitting: cast metal boxes with gasketed covers in damp locations, connection complete with insulated bushings.
- .2 Rigid aluminum conduit.
- .3 RGS: rigid galvanized steel conduit.
- .4 EMT: electrical metallic tubing (use of EMT is not permitted for any new work).

.2 Flexible Metal Conduit:

- .1 Liquid-Tight Flexible Metal Conduit: continuous interlocked aluminum armour, coated with liquid-tight jacket of flexible PVC, minimum 12mm trade size.
- .2 Liquid-Tight Flexible Metal Conduit Fittings: aluminum fittings with compression type ferrule and neoprene gasket sealing rings.
- .3 Miscellaneous Fittings: locknuts, bushings, reducers, chase nipples, 3-piece unions, split couplings, plugs, and expansion fittings specifically designed for their particular application all of aluminum.

2.3 Non-Metallic Conduit

.1 Rigid PVC (un-plasticized) Conduit: To CSA C22.2 No. 211.2-M1984, Schedule 40.

.2 Fittings: Threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.

.3 Solvent: As recommended by conduit manufacturer.

Part 3 EXECUTION

3.1 Installation Of Conduit

.1 Where conduit is run exposed, run parallel to building lines. Where conduits are installed together, in groupings of two (2) or more, space evenly, make bends concentric and mount on Unistrut racks.

.2 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.

.3 Provide underground warning tapes 200 mm above all underground conduits. Tape shall be red, 50 mm wide, metallic detectable type.

.4 Where conduit is required to be bent, do not heat, and do not bend conduit in such a way as to reduce pipe cross section area at any point. Radii of bends shall be as per CEC.

.5 For all runs of conduit, do not include more than equivalent of 4-quarter bends. Provide conduit fittings, pull boxes and junction boxes where necessary. Pulling elbows shall not be used except by special permission.

.6 Where possible, install conduits so that moisture is not trapped, cap turned up conduits to prevent the entrance of dirt or moisture during construction. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

.7 Take care in reaming ends of all conduits to ensure a smooth interior finish that will not damage the insulation of the wires.

.8 Use insulated non-metallic bushings on all conduit terminations.

.9 Ensure electrical continuity in all conduit systems.

.10 All conduit shown exposed in finished areas is to be free of labels and trademarks.

.11 Install a 90 lb test line in all conduits left empty; including those which others will pull cables, wires, etc.

.12 Conduits and ducts crossing building expansion joints shall have conduit expansion fittings to suit the type of conduit used.

.13 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables or cable trays pierce fire separations, seal openings with approved sealant.

.14 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits shown on the drawings are installed, wall openings shall be closed with material compatible with the wall construction.

.15 Provide necessary flashing and pitch pockets, making watertight joints where conduits pass through roof or watertight membranes.

.16 Install an equipment ground wire in all conduits.

.17 Avoid the use of dissimilar metals throughout system, to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

.18 Cut conduit straight, properly ream, cut threads and brush threads clean.

.19 Fasten conduit terminations in enclosures with two locknuts and terminate with bushing. Install locknuts inside and outside enclosure.

.20 At all motors, transformers and similar vibrating or moving equipment, provide a short length of liquid tight flexible conduit before connecting to the terminal box. Minimum length shall be 450mm.

.21 Provide a separate ground wire within flexible conduit, bonded to the motor frame and system ground.

.22 Install conduit to conserve headroom and cause minimum interference in spaces through which conduit passes.

.23 Install conduit so as not to interfere with ceiling inserts, luminaires, ventilation ducts or outlets.

.24 Alter routing to avoid structural obstructions, keeping crossovers to a minimum.

.25 Install exposed conduit and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls and structural members.

3.2 Conduit Installation Schedule

.1 Provide conduit types for applications indicated, except where otherwise required by CEC:

	Conduit/Duct Type	*Application*
a)	Rigid PVC conduit (Schedule 40)	Underground in contact with soil for all sizes and in within dry well.
b)	Rigid aluminum conduit	Use throughout except where noted otherwise
c)	Rigid galvanized steel conduit (RGS)	Use in wet wells and where specifically noted in the documents
b)	Liquid-tight flex aluminum armour:	Connections to motors and equipment throughout as applicable.
e)	Electrical metallic tubing (EMT)	Not permitted for any new work
f)	PVC Type DB 2 Duct	Not permitted for any new work

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements. Section 26-00-10

1.3 Coordination

.1 Coordinate with other work, including wire and cable, boxes and fittings and panel work, as necessary to interface installation of electrical raceways and components with other work.

.2 Coordinate installation of cable trays and wireways, which penetrate fire rated walls, floors, or ceilings by installing fire stopping sealant. Ensure that integrity of the fire rated element is maintained.

.3 Coordinate with air ducts and other building components.

.4 Provide tray access as required by code.

Part 2 PRODUCTS

2.1 Cable Trays

.1 Cable trays and fittings: to CSA C22.2 No 126 M1980 and EEMAC F5 1, 1976, and as follows:

.1 Type: ladder, rung spacing 22 cm, I-beam rail design.

.2 CSA Class: E (112 kg/m loading for 6 m spans).

.3 Size: Width and depth as shown on drawings.

.4 Material: aluminum.

.5 Accessories and Fittings: Horizontal and vertical elbows, end plates, dropouts, vertical risers and drops, tees, wyes, expansion joints and reducers, manufactured for cable tray supplied, cover for exterior trays, aluminum.

.6 Elbows and offsets to have a bending radius as noted on drawings.

.7 As manufactured by Thomas and Betts, B-Line, Unitray.

2.2 Instrument Tray (Cable Channel)

.1 Where noted on drawings, and as required to manage cables, provide instrument tray with the following features:

.1 Aluminum construction with required fittings and accessories.

.2 Depth of 38mm, width as noted on drawings (up to 150mm wide).

.3 As manufactured by Thomas and Betts, B-Line, Unitray.

Part 3 EXECUTION

3.1 Installation Of Cable Trays

.1 Support and secure cable trays.

.2 Install CSA/ULC approved fire stopping at all cable trays and wireways, which pass through fire rated walls, floors or ceilings.

.3 Install trays above the lighting fixtures and below duct work and piping or as specifically noted.

.4 All trays shall be checked for surface smoothness prior to installation. Remove all burrs and ridges from tray surfaces in contact with cabling. All cut ends shall be painted to prevent corrosion.

.5 Provide cable drop-outs at cable tray ends as required.

.6 Clamp trays to all cable tray supports with approved clamps.

.7 Provide a continuous #2, or as noted, green insulated grounding conductor in all trays. Bond the conductor to each tray section at 6 m intervals using a ground clamp as provided by tray manufacturer for dissimilar metals. Bond MCC, PLC cabinet, transformer, etc., to tray. Interconnect the grounds in adjacent tray approximately every 20 m using #2 green insulated cable as applicable.

.8 Use nylon tie wrap to secure cables to trays. Tie wraps used outside must be black UV resistant type with metal inserts.

.9 As much as is practical, group cables of one system together and run cables in an orderly fashion.

.10 Cable trays are shown diagrammatically and to scale. Coordinate exact location of trays on site and adjust to suit. Include for the installation of additional cable tray fittings as required to suit the work.

.11 Support interior trays on strut suspended on all-threaded rods or wall brackets where applicable and/or support as specifically noted.

.12 Provide other supports as required.

.13 When pulling larger Teck cables, attach pulleys at major pull points independently of the tray and tray support system.

.14 Install covers to all trays as specifically noted.

.15 De-rate all cables carrying current under 30A, as per the CEC, to allow for 0% spacing between these cables. All cables carrying current over 50A to be 100% spaced as per CEC.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements Section 26-00-10

Part 2 PRODUCTS

2.1 Identification Materials

.1 Equipment Nameplates:

.1 For electrical power equipment utilize 3mm thick ‘lamacoid’ plastic engraving sheet, white face, black core, mechanically attached, sizes as follows unless otherwise specified:

.1 Size 1: 20 mm high with 5 mm high letters.

.2 Size 2: 20 mm high with 8 mm high letters.

.3 Size 3: 25 mm high with 12 mm high letters.

.2 For instrument and control devices, each device shall be labelled with a stamped or engraved equipment identification tag number.

.1 Nameplate tags for all instrument and control devices shall be stainless steel and affixed to the device with either nylon tie wraps or adhesive.

.1 Do not use adhesive on curved surfaces

.2 Conductor and wire identification materials:

.1 Where individual conductors and wires are labelled use heat-shrinkable identification sleeves:

.1 Use white tubing sleeves sized to fit the insulation diameter of the conductor

.2 All conductor labels shall be machine printed letters and numbers, minimum 3mm high, on sleeves with permanent black ink.

.3 Adhesive type labels will not be permitted.

.4 Acceptable marker system: Bradysleeve WMS Series by Brady

Part 3 EXECUTION

3.1 Nameplate Identification Of Equipment

.1 Identify all equipment with lamacoid nameplates as indicated in the ‘Equipment Identification Schedule’ provided in this Section and as specifically advised elsewhere.

.2 Existing equipment affected by this contract shall be re-labeled (when applicable).

.3 All devices/equipment/loads must be labeled.

3.2 Panelboard Directories

.1 Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory.

.2 Update existing modified panel directories (When applicable).

.3 Provide an accurate and neatly typewritten directory for each panel. Use the directory provided by the manufacturer and note loads in numerical order with odd numbered circuits on the left side and even numbered circuits on the right side. Note all loads, spares, and spaces.

3.3 Identification Of Pull And Junction Boxes

.1 Identify pull and junction boxes:

.1 Use boxes which are factory painted.

.2 Apply size 2 lamacoid nameplate to cover each box. Identify system name. Where sequence identification is required, identify system name and number.

.3 Identify small pull and junction boxes, 100mm or less in size, by applying a typewritten stick-on label.

.4 Note system, voltage, circuits, etc. to clearly identify function.

3.4 Color Identification Of Wiring

.1 Identify No. 4/0 AWG wiring and smaller by continuous insulation colour.

.2 Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.

.3 Identify 120/208/240-volt and 347/600-volt systems using different wire colours.

.4 Identify each power and control conductor with the complete circuit conductor number at both ends.

.5 Maintain phase sequence and colour coding throughout.

.6 Colour code to CSA C22.1 and as listed below or as shown on drawings. For the purpose of colour-coding, the drawings take precedence over the specifications.

.1 Power wiring, phase A-B-C from left to right: red-black-blue

.2 120 VAC control power: black for hot, white for neutral

.3 VDC control: red for positive, black for negative

.4 Analog signal: white for positive, black for negative

.5 Intrinsically safe wiring: blue sheath.

.7 Use colour coded conductors in communication cables, matched throughout system.

3.5 Conductor Identification and Labelling of Individual Wires

.1 Use heat-shrinkable identification sleeves for conductors Size No. 10AWG and smaller.

.2 All conductors shall be identified and numbered in accordance with the control schematic.

.3 Make printed characters permanent, heat-shrink process. All conductor labels shall be of the heat shrink type, appropriately sized for the conductor wire gauge. Adhesive type style labels will not be permitted.

.4 Provide the required heat-shrink and printing equipment complete with software where applicable on site until plant commissioning is completed.

.5 Where 'ring' or 'fork' type terminals are used, extend sleeve over crimp-on-base after installation of terminal and heat-shrink in place.

3.6 Cable And Conduit Identification

.1 Provide a lamacoid identification tag for each end of each cable and conduit. Provide tags as shown on schedule and as determined on site. Attach with UV resistant tie-wraps.

.1 Label all power, control, instrumentation, and data cable/conduit with a unique tag number as reference to the cable/conduit schedule provided on the drawings.

.2 Affix an identification at every location where a cable/conduit enters a device, panel, or equipment. The identification tag must include the unique tag number and where the opposite end of the cable/conduit is terminated, along with branch circuit numbers where applicable.

3.7 Nameplate Identification Schedule

.1 Refer to the following schedule for nameplate identification and sizing requirements:

– Equipment Nameplate Identification Schedule –

Equipment	Equip. Colour	Nameplate Identification	Nameplate Size
Distribution Centres	Grey	Distribution Centre designation, amperage, and voltage.	2
		Loads controlled by each overcurrent protective device.	1
Panelboards	Grey	Panelboard designation, voltage, phase.	2
Motor Control Centres	Grey	M.C.C. designation, amperage, voltage, no. of phases, and no. of wires.	2
		Motors or loads controlled by each unit; include identification tag number of circuit breaker/motor starter along with name and identification tag number of the load it controls	1
		Relay terminal and transformer compartments.	1
Manual Motor Starters	N/A	Load controlled.	1

On/Off Switches	N/A	Load controlled.	1
Disconnect Switches Magnetic Motor Starters and Contactors	Grey	Voltage and equipment controlled.	2
Wireways	Grey	Voltage system designation.	2
Line Voltage Cabinets and Enclosures	Grey	Designation and voltage.	2
Conduits	N/A	Conduit designation at each end of conduit and at all boxes, floor and wall penetrations, and at 20m intervals along straight runs.	1
TECK Cables		1kV and less – Black jacket 5kV and less – Yellow jacket 15kV and less – Red jacket Cable designation at each end of Cable and at all boxes, floor and wall penetrations.	1
Low Voltage Cabinets	Grey	Cabinet designation of system.	1
Transformers	Grey	Voltage, size, designation.	1
Duplex Receptacles	N/A	Power source, voltage, and circuit.	1
Special Purpose Receptacles	N/A	Power source, voltage, rating, load it controls.	1

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Allowances:	Section 01-21-00
.2	Electrical General Requirements:	Section 26-01-00
.3	Electrical Testing and Starting:	Section 26-08-10

1.3 Description

.1 An Electrical Arc Flash and Coordination Study (herein referred to as ‘the Study’) of the facility electrical power distribution system shall be carried out under Cash Allowance as described herein and as per Section 01-21-00.

.2 The Study will include the following:

- .1 Development / updating of a software model of the electrical power distribution.
- .2 Calculations and analysis to determine short circuit / fault values
- .3 Determination of protective device relay settings (coordination study)
- .4 Determination of maximum expected incident energy levels at electrical switchgear (arc flash study).
- .5 Documentation including:
  - .1 Protective device relay settings to be applied to new and modified equipment.
  - .2 Labels to be applied to equipment identifying incident energy levels, arc-flash protection boundary and personal protective equipment (PPE) requirements.
  - .3 Summary report.

Part 2 PRODUCTS

2.1 Protective Devices

.1 Relay settings, CT ratios and fuse sizes have been selected on a preliminary basis for design purposes. Final selection shall be based on the results of this analysis and shall be included at no extra cost.

Part 3 EXECUTION

3.1 Installation

.1 The Contractor shall complete the following:

.1 Field adjustments to all protective relay devices as recommended in the Study. This includes modification to the settings of existing relays throughout the site as recommended in the Study and as required.

.2 Apply arc-flash labels to electrical equipment noted in the Study documentation.

.2 The Study itself is to be completed by a Professional Engineer registered under APEGA. The work shall be performed to the IEEE 1584 requirements and using industry best practices. The required documentation from the Study will be made available to the Contractor, prior to the testing and start-up phase of the work, for implementing as described above.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Electrical General Requirements:	Section 26-00-10
.2	Startup and Commissioning	Division 01

1.3 Technical Requirements

.1 This section specifies general requirements common to all starting and testing of electrical equipment and systems. See various sections for specific tests and as noted herein.

.2 Except where otherwise specified, arrange, and pay for all testing. Provide all equipment and tools necessary to perform the specified testing.

.3 If tests results do not confirm with applicable requirements, repair, replace, adjust, or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.4 Correct all deficiencies found during the testing process.

.5 Prior to testing, ensure all electrical equipment is cleaned and free of dirt.

.6 After testing, protect equipment subject to dust from construction activities.

.7 Prior to testing, prepare a schedule of tests. Provide ten (10) days’ notice to the Owner’s Representative prior to commencing testing.

.8 Notify the Owner’s Representative when starting and testing of all systems has been completed.

.9 Do not conceal or cover equipment until inspected, tested and approved by the Owner’s Representative.

.10 Assume all costs associated with starting, testing and balancing, including the supply of testing equipment.

.11 Provide access to equipment, remove covers, operate systems, correct deficiencies, and generally prove system performance as specified and to the full satisfaction of the Owner and/or the Owner’s Representative.

.12 Prior to starting equipment or systems, review manufacturers' installation operation and starting instructions. Confirm with manufacture that all tests specified will not void any warranties.

.13 Record all data gathered on site on contractor prepared test report forms, sign, and date each form.

.14 Note deficiencies, summarize all results, and make recommendations for corrections. Retest corrected deficiencies.

.15 Provide one (1) copy of testing report to the Owner's Representative for review. When accepted, submit six (6) bound copies of all test results including summary and recommendations for any corrective action. Include final test sheets in maintenance manuals.

.16 Specified testing applies to all new work and equipment. Specified testing also applies to modifications to existing equipment and connections to existing equipment as applicable.

.17 Tests completed by the testing agency shall be documented on standard test forms utilized by them.

.18 Tests completed by manufacturer shall be documented on standard test forms.

.19 Various tests are to be completed by the Contractor as noted. Use as many sheets as required to clearly show the area or item tested.

1.4 Testing Agency Qualifications

.1 Registered testing firm whose normal day-to-day business is electrical testing.

.2 Testing agent shall be independent of the Contractor and shall not have any financial or other interests in or with the Contractor.

.3 Minimum of eight (8) years' experience in the maintenance and testing of electrical equipment and systems of all voltage levels up to and including 25 kV class.

.4 Employ at least one (1) electrician holding a current journeymen's certificate in the province of Alberta.

.5 Personnel shall be experienced in the use of the following test equipment:

.1 Meggers 500VDC and 1000VDC.

.2 Hipot test equipment up to 100 kV DC.

.3 Capacitance bridges.

.4 Transformer ratio test equipment.

.5 Contact resistance testers (ductor).

.6 Protective relay test equipment of the current injection type for the testing and calibration of induction and solid state protective devices.

.6 Tests noted herein shall be by a professional testing agency.

.7 Unless otherwise noted, all testing specified to be done by the testing agency shall be done by one company.

1.5 Testing By Manufacturer

.1 Arrange and pay for qualified manufacturer's representatives to supervise starting and testing of the following electrical equipment and systems, including but not limited to:

.1 Automatic Transfer Switch (ATS); where applicable

.2 600V MCC's

.3 Variable Frequency Drives (VFD's); where applicable

.4 Stand-by Generator; where applicable

.5 Soft-Starts; where applicable

.6 Active Harmonic Filters; where applicable

.2 Manufacturer's personnel shall be experienced in the design and operation of equipment and systems being started and have the ability to interpret results of readings and tests, and report results in a logical fashion.

1.6 Testing By Contractor

.1 Energizing Main Electrical System

.1 Prior to energizing main electrical system:

.1 Verify voltage and phase rotation.

.2 Ensure all testing by testing agency has been completed and deficiencies have been corrected.

.2 Testing of Wiring and Wiring Devices

.1 Test all wiring devices for correct operation and polarity.

.2 Confirm ground integrity to all wiring receptacles.

.3 Verify and ensure that panel directories are correct.

.3 Starting Motors

.1 Prior to starting motors:

.1 Confirm motor nameplate data with motor starter heater overloads.

.2 Verify phase rotation.

.3 Ensure disconnects are installed where indicated.

.4 Confirm labelling of motors, disconnects and starters.

.2 Measure and record full load amp readings for all motors.

.4 Pumps / Process Equipment

.1 Test all power and control functions.

.5 Devices

.1 Test all devices including but not limited to receptacles, switches, welding outlets, lighting control, etc.

.6 Mechanical Loads

.1 Test all motors, mechanical and miscellaneous loads.

1.7 Testing By Testing Agency

.1 Distribution Equipment - Low Voltage

.1 Enclosure

.1 Visual inspection.

.2 Torque all bus connections to manufacturer’s requirements and seal with red lacquer.

.3 Megger test main bus.

.4 Check phasing and continuity of horizontal and vertical bus.

.5 Test switching schemes and key interlocks.

.2 Wiring Checks

.1 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three-line diagrams and project specifications.

.2 Test each circuit for continuity using a buzzer or similar device.

.3 All current circuits shall be injected, all voltage circuits shall be powered at 120 volts, and all devices functioned and checked against control schematic diagram.

.4 Check polarity and verify phase relationships on all three phase metering circuits.

.5 Where errors are discovered and changes are required, mark-up and note on the Vendor/Manufacturer's prints and the corrective action required.

.3 Instrumentation (when applicable)

.1 Test and calibrate all meters and digital metering units in accordance with manufacturer's instructions.

.2 Test and calibrate all electronic instruments in accordance with manufacturer's instructions.

.3 Perform wiring checks as listed above.

.4 Breakers - Molded Case Breakers 100 Amp Frame and Larger

.1 Visual inspection.

.2 Ductor test.

.3 Megger test.

.4 Mechanical function test.

.5 Set all units with adjustable magnetic trip units.

.6 Where solid state protection is provided with large breakers, test units as follows:

.1 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.

.2 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instruction.

.3 If the manufacturer's tester is not available, use an approved relay tester unit with the proper test data and test accessories.

.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of the relay circuit to test the trip operation.

.5 Check C/T and P/T ratios and compare to coordination data.

1.8 Motor Control Centres

.1 Visual inspection and cleaning.

.2 Remove starter covers to expose all bussing and confirm phasing continuity and rotation and the identification of bussing.

.3 Torque test all bus connections and cable terminations to manufacturer's recommended levels.

.4 After the bus connections have been torque tested, apply red lacquer to bolted connections.

.5 Megger test - phase to phase and phase to ground.

.6 Ductor test – refer to ductor testing in this section.

.7 Test key interlocks.

.8 Test digital metering system when applicable.

.9 Where MCC's are provided with arc flash hazard protection and arc resistant features inspect and verify operation of shutter assemblies, pressure relief system (where provided), door latch assemblies, and power stab withdrawal interlocks.

.10 Test all new MCC's.

1.9 Variable Speed Drives (Where Applicable)

.1 Provide all testing as outlined in Section 26-29-23 (Variable Speed Drives)

.2 For VFD's installed in MCC's, coordinate testing activities with those listed within Motor Control Centres indicated above within this Section.

1.10 Reduced Voltage Soft Starters – RVSS (Where Applicable)

.1 Factory Testing:

.1 Provide certification that the following tests have been successfully completed; factory tests to be perform include, but are not limited to:

.1 Testing of power transistors, diodes, and other solid-state components to ensure correct function and highest reliability.

.2 All control printed circuit boards shall be dynamically tested while heat cycled.

.3 Power semiconductors must be fully tested for proper electrical characteristics (dv/dt, di/dt, etc.)

.4 Functional testing of chips (CMOS, TTL, LINEAR, etc.).

.5 Functional testing of power capacitors and active components.

.6 Inspection of sub-assemblies and/or testing for conformance to manufacturer's engineering and quality assurance specifications.

.7 All power components are to be run under "worst case" conditions for at least 20 minutes.

.8 The RVSS to be functionally tested with a motor for 20 minutes before shipment to assure proper operation per specification to applicable CSA and IEEE standards.

.9 Factory tests to be done by manufacturer to ensure proper system operation, freedom from grounds and open and short circuits.

.10 Conduct visual equipment inspection and functional test of assembled RVSS units.

.2 Field Testing

.1 Perform testing of individual components within the RVSS assembly as indicated elsewhere in this Section (i.e., circuit breaker, contactors, capacitors, overload protection, etc.)

.2 Complete a start-up test for each RVSS. Confirm correct operation of all programmed and diagnostic functions.

.3 Complete a visual inspection of each RVSS, test and check all connections and confirm correct installation.

.4 Calibrate all settings as required.

.5 Measure temperature over a 24-hour period for each RVSS to confirm operation within temperature limitations.

.6 Provide a written report of the start-up and test for each RVSS and include parameter settings.

.7 Coordinate with automation trade and user group.

1.11 Active Harmonic Filters (Where Applicable)

.1 Provide all testing as outlined in Section 26-35-26.11 (Active Harmonic Filter)

.2 For AHF's installed in MCC's, coordinate testing activities with those listed within Motor Control Centres indicated above within this Section.

1.12 Ductor Testing

.1 Perform a ductor test for the following:

.1 MCC bus and cabling connections.

.2 Breaker (not in starters) 100A and larger.

.3 Starters with breakers 100A and larger.

.4 VFD and Soft Start main breakers and connection to the MCC bus (where applicable).

.5 The ductor test shall check the connection from the MCC bus to the load side of the breaker.

1.13 Protective Relaying

.1 Set and test protective relays to the settings provided in the coordination study.

.2 The manufacturer's instructions for the specific relay must always be used for information concerning connections, adjustments, repairs, timing and data.

.3 Solid-State Relays:

.1 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.

.2 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instructions.

.3 If the manufacturer's tester is not available, use an approved relay tester unit with the proper test data and test accessories.

.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of the relay circuit to test the trip operation.

.4 Check CT and PT ratios and compare to coordination data.

1.14 Testing Of Wiring And Cable (120/208 V & 600 V Including Control Cables)

.1 Test conductors at distribution centres, MCC's and panelboards, etc. for insulation resistance to ground. Use 1000 VDC megger for testing 1000V insulation levels and 1000 VDC megger for 600-volt cables. Test 300V cables as above at 500 VDC.

.2 Test service grounding conductors for ground resistance.

.3 Torque all connections.

.4 Test all feeders and cables for distribution, motors, transformers, VFD's etc.

.5 Cable testing may be completed by the Contractor instead of by a testing agency.

1.15 Ground Resistance Testing

.1 Measure ground resistance with earth test megger to verify compliance with CSA C22.2 No. 0.4-1982 and Canadian Electrical Code.

.2 Test all transformers/MCC system grounds and equipment grounds.

.3 Test and ensure ground integrity to metallic non-electrical components such as supports, handrails, piping, building structure, etc.

1.16 Load Balance Testing

.1 Perform load tests with as many loads on as possible.

.2 Test load balance on all feeders at distribution centres, motor control centres and panelboards.

.3 If load unbalance exceeds 15%, advise the Owner's Representative and if so directed reconnect circuits to balance loads. Revise panelboard directories and wiring identification accordingly.

1.17 Voltage Testing And Adjusting

.1 Test voltage at the service entry point, motor control centres, the secondary of transformers, panels, and motors. Record the voltages for a period of four hours during a normal workday and after building is adequately completed and loaded.

.2 Adjust transformer tap settings to compensate for under-voltage conditions, if directed to do so by the Owner's Representative.

1.18 Digital Power Metering (Where Applicable)

.1 Confirm correct wiring.

.2 Confirm correct CT ratios.

.3 Test digital power meters to confirm correct operation and function.

.4 Provide test sheets.

1.19 Emergency Power (where applicable)

.1 Prove correct operation of overall emergency power system.

.2 Coordinate with Owner as required to avoid disruption to ongoing process.

.3 Generator:

.1 Provide all testing as outlined in Section 26-32-11 (Generator)

.4 Automatic Transfer Switch

.1 Provide all testing as outlined in Section 26-32-91 (Automatic Transfer Switch)

1.20 Dry Type Transformers

.1 Visual inspection.

.2 Torque test all cable terminations.

.3 Megger test.

1.21 Lighting

.1 Testing operation and switching.

1.22 PLC System

.1 See Section 26-09-00 – Control Devices, Instrumentation, SCADA, Communication Network for PLC and control system testing details.

1.23 Communication System

.1 See Section 26-09-00 – Control Devices, Instrumentation, SCADA, Communication Network for communication system testing details.

Part 2 PRODUCTS

2.1 Not Used.

Part 3 EXECUTION

3.1 General

.1 Coordinate work with manufacturer and testing agency.

.2 Provide filled in test sheets to the Owner's Representative for review and include with O&M documentation.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

1.3 Technical Requirements

.1 Provide demonstration and instruction sessions to familiarize Owner's operation and maintenance personnel with electrical systems and their operation and maintenance.

.2 Provide separate instruction/training sessions for operations personnel and maintenance personnel.

1.4 Manufacturer's Site Services

.1 Arrange and pay for appropriately qualified manufacturer's representatives to provide or assist in providing electrical equipment and systems demonstration and instruction as specified herein.

1.5 Contractor/Owner Coordination

.1 Establish agendas for demonstration and instruction sessions in conjunction with Owner. Coordinate scheduling of sessions with Owner.

1.6 Demonstrations And Instruction Seminars

.1 Prepare a schedule identifying the proposed sequence of demonstration for the various systems and equipment. Sequence of demonstration shall correspond to full system starting.

.2 Maintenance manuals shall be used as a text for instruction seminars.

.3 Demonstrate specific starting and general maintenance requirements for each system and each piece of equipment.

.4 Answer all questions by Owner at demonstrations. If unable to satisfactorily answer questions immediately, provide written response within three (3) days.

.5 As a minimum, discuss and explain all electrical systems, control, etc.

.6 Allow for one (1) day on site training and demonstration of system features, functions and operation.

Part 2 PRODUCTS

2.1 Not Used.

Part 3 EXECUTION

3.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Electrical General Requirements:	Section 26-00-10
.2	Wires and Cable (0-1000 V):	Section 26-05-21
.3	Motor Control Centres:	Section 26-24-19
.4	Cabinets and Enclosures:	Section 26-27-16
.5	Motor Starters, Contactors, and Relays:	Section 26-29-13
.6	Variable Speed Drives	Section 26-29-23
.7	Generator	Section 26-32-11
.8	Automatic Transfer Switch:	Section 26-32-91

1.3 Operational Philosophy – Executive Summary

.1 The Hearthstone Sanitary Lift Station consists of an above ground building positioned on top of a below-grade dry well. Adjacent to the dry well is a below-grade wet well containing 2 wastewater discharge pumps. Wastewater flows from the surrounding development are directed into an inlet manhole located immediately upstream of the station and continued into the wet well.

.2 Allowance is made at the inlet manhole for the future addition of a grinder should one be required for management of solids.

.3 Levels are monitored at both the inlet manhole and the wet well. Pressure and flow are monitored on discharge piping located in the dry well. Monitored levels are utilized to operate the pumps to periodically empty the wet well.

.4 A motorized knife gate at the wet well inlet allows isolation of the wet well.

.5 Discharge pumps operate with speed control via VFD to optimize the flow rate to meet the demand as it increases with the growth of the surrounding development. The pumps will operate in a duty/standby configuration.

.6 In addition to the above noted process operation, monitoring of the following building services aspects are included in the station

- .1 Fixed gas monitoring (H2S and LEL)
- .2 Power system monitoring (Status of utility, generator, and ATS)
- .3 Intrusion detection
- .4 Building temperature monitoring
- .5 Ventilation system status

.7 The system description included above is intended as a high-level summary only. Refer to the Control Narrative, separate from this specification, for detailed description of facility operations.

Part 2 PRODUCTS

2.1 Control System

.1 Provide a programmable logic controller (PLC) installed in the control cabinet.

.2 Main Programmable Logic Controller (PLC)

- .1 GE/Emerson Rx3i series
- .2 Part number: refer to bill of material on drawings

.3 PLC Specifications:

- .1 Supports Ethernet/IP communications.
- .2 Two (3) Ethernet/IP 10/100/1000 ports (2 switched ports)
- .3 One (1) USB port.
- .4 64 MB user memory.

.4 Provide all required cables.

.5 Provide manufacturer recommended power supply capable of powering all required cards.

.6 Provide input and output cards as specified on the drawings

.7 Provide latest software.

.8 Provide manuals for the PLC, input and output cards, communications cards, and programming software.

.9 Program the PLC

2.2 Human Machine Interface (HMI)

.1 HMI Screen

- .1 Nexcom 2180 series panel pc
- .2 Part number: refer to bill of material on drawings

.2 HMI Specifications

- .1 21.5" TFT Full HD 10-point touchscreen display (16:9 ratio)
- .2 1920 x 1080 resolution
- .3 Heavy Industrial Panel PC (fanless)
- .4 6th Generation Intel Core i5 processor
- .5 Support for PROFINET, PROFIBUS, DeviceNet, Ethernet/IP, and EtherCAT protocols
- .6 Dual 10/100/1000 ethernet interface (2 x RJ45 ports)
- .7 Aluminum front bezel
- .8 Capable of front panel mount in control cabinet

2.3 Communication Network

.1 Ethernet Switch

- .1 RedLion Sixnet SLX series industrial ethernet switch
- .2 Part number: refer to bill of material on drawings
- .3 Quantity: as noted on drawings
- .4 Ethernet Switch Specifications:
  - .1 Ten Port (10-port) Gigabit Managed Industrial Ethernet Switch
    - .1 Qty. of 10/100BaseTX RJ-45 Ports: seven (7)
    - .2 Qty. of 10/100/1000BaseTX RJ-45 Port: one (1)

.2 Qty. of Gigabit SFP/RJ45 Combination ports: two (2)

.1 1000BaseSX/LX Fiber with LC style connectors or 10/100/1000BaseTX Copper with RJ-45 connectors

.3 10 - 30 VDC operation.

.4 DIN rail mounted as shown on drawings.

.5 Minimum one port to be left available on the switch for programming purposes.

2.4 Power Devices and Terminations

.1 Uninterruptible Power Supply (UPS):

.1 EATON Powerware 9SX series

.2 Part number: refer to bill of material on drawings

.3 UPS Specification:

.1 5 min run time at full load.

.2 120V AC, 60 Hz single phase input and output.

.3 True on-line backup protection.

.4 Complete with INDRELAY-MS industrial relay card for UPS monitoring by the PLC.

.2 DC Power Supplies:

.1 24VDC PS

.1 Qty. 1

.2 Weidmuller Pro Max Power Supply, as shown on drawings

.3 120W, 24VDC, 5A

.2 12VDC PS

.1 Qty. 1

.2 Weidmuller Pro Max Power Supply, as shown on drawings

.3 72W, 12VDC, 6A

.3 Install DC Power Supplies as shown on drawings.

.4 Power Supplies to be DIN rail mount.

.5 Power Supplies quantities are shown on the drawings.

.3 Control Relays:

.1 Use Omron LY series complete with DIN rail base or approved alternative.

.2 Provide 4 pole, double throw contacts complete with DIN rail base.

.3 For latching relay applications, use Omron MMK series complete with DIN rail base.

.4 Operation coil rated for voltage required for application.

.5 Approved alternate manufacturers: Allen Bradley, Square D, Cutler Hammer, and Siemens

.6 These devices are specified for use in supplier fabricated control panels. All like devices must be of one manufacturer regardless of installation location.

.4 Terminal Blocks:

.1 Standard terminal blocks, Weidmuller WDU6 or approved alternative.

.2 Circuit breaker terminal blocks, Weidmuller 9926 series or approved alternative.

.3 Fuse holder terminal blocks, Weidmuller KDKS1 series c/w fuse blown indicator lights or approved alternative.

.4 For each DIN rail, provide a grounding terminal block. Connect to the ground bar with a stranded #12 minimum Green insulated wire. Use compression ringed connectors at the ground bar end.

.5 Provide all necessary mounting hardware, Din rail, end brackets, end plates for a complete installation.

.6 Choose one type of DIN rail to hold all rail mounted equipment, including relays, etc. DIN rail type is consistent throughout the cabinet.

.7 Extend DIN rails full length of adjacent wire ways.

2.5 Electrical Equipment Communication

.1 Variable Frequency Drives (VFD):

.1 VFD’s will communicate to the PLC over EtherNet/IP.

.2 Provide the required communication modules if necessary.

.2 MCC Digital Power Meter (DPM):

.1 The DPM will communicate to the PLC over EtherNet/IP.

.2 Provide the required communication modules if necessary.

.3 Generator:

.1 The Generator will communicate to the PLC over hardwired connections.

.2 Provide the required communication modules if necessary.

.4 Automatic Transfer Switch (ATS):

.1 The ATS will communicate to the PLC over EtherNet/IP.

.2 Provide the required communication modules if necessary.

.5 Flow Meter:

.1 The flow meter(s) will communicate to the PLC over EtherNet/IP.

.2 Provide the required communication modules if necessary.

2.6 Instrumentation

.1 Please refer to the instruments data sheets provided within the following 32-pages

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GAS MONITOR - HYDROGEN SULFIDE (H2S)

CLIENT:
Mattamy (Sherwood Park) Ltd.
Strathcona County, AB

PROJECT:
Hearthstone Sanitary Lift Station

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TRANSDUCER	1	Tag No.	**10-AE-701**
	2	Manufacturer	**Honeywell**
	3	Model No.	**XNX EC Series (XNXXSH1SS)**
	4	Type	**Electrochemical cell type detector**
	5	Service	**Hydrogen Sulfide**
	6	Material	**316 SST**
	7	Protection Classification	**CSA Class 1 Div. 2 Group C/D**
	8	Finish	**Electropolished**
	9	Calibrated Measurement Range	**0 to 50 ppm**
	10	Mounting	**Surface mounted (via manufacturer's remote mount kit)**
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TRANSMITTER	21	Tag No.	**10-AIT-701**
	22	Model No.	**XNX EC Series (XNX-UT-SE-RHNNN)**
	23	Mounting	**Surface**
	24	Output(s)	**H2S concentration (continuous), Alarm (multi-point)**
	25	Display / Units	**LCD Backlit** / **ppm**
	26	Area Classification	**CSA Class 1 Div. 2 Group C/D - IP66 rated**
	27	Finish	**Painted**
	28	Power Supply	**24VDC**
	29	Input / Output Signals	**Analog 4-20mA output , relay output contacts (3x N.O./N.C.)**
	30	Enclosure	**316 SST Housing and Fittings**
	31		
	32		
	33		
GENERAL	34	Procurement	**1 - Transducer / Sensor**
	35		**1 - Transmitter**
	36		**1 - Manufacturer's remote sensor mounting kit (c/w cable)**
	37	Accessories	**Installation, Operation and Maintenance Manual**
	38	Alternates	**Equivalent as manufactured by Otis, Sensidyne, Emerson Det-Tronics**
	39		
	40		
	41		
	42		

Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.
4. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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GAS MONITOR - HYDROGEN SULFIDE (H2S)

CLIENT:
Mattamy (Sherwood Park) Ltd.
Strathcona County, AB

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Hearthstone Sanitary Lift Station

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TRANSDUCER	1	Tag No.	**10-AE-702**
	2	Manufacturer	**Honeywell**
	3	Model No.	**XNX EC Series (XNXXSH1SS)**
	4	Type	**Electrochemical cell type detector**
	5	Service	**Hydrogen Sulfide**
	6	Material	**316 SST**
	7	Protection Classification	**CSA Class 1 Div. 2 Group C/D**
	8	Finish	**Electropolished**
	9	Calibrated Measurement Range	**0 to 50 ppm**
	10	Mounting	**Surface mounted (via manufacturer's remote mount kit)**
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TRANSMITTER	21	Tag No.	**10-AIT-702**
	22	Model No.	**XNX EC Series (XNX-UT-SE-RHNNN)**
	23	Mounting	**Surface**
	24	Output(s)	**H2S concentration (continuous), Alarm (multi-point)**
	25	Display / Units	**LCD Backlit** / **ppm**
	26	Area Classification	**CSA Class 1 Div. 2 Group C/D - IP66 rated**
	27	Finish	**Painted**
	28	Power Supply	**24VDC**
	29	Input / Output Signals	**Analog 4-20mA output , relay output contacts (3x N.O./N.C.)**
	30	Enclosure	**316 SST Housing and Fittings**
	31		
	32		
	33		
GENERAL	34	Procurement	**1 - Transducer / Sensor**
	35		**1 - Transmitter**
	36		**1 - Manufacturer's remote sensor mounting kit (c/w cable)**
	37	Accessories	**Installation, Operation and Maintenance Manual**
	38	Alternates	**Equivalent as manufactured by Otis, Sensidyne, Emerson Det-Tronics**
	39		
	40		
	41		
	42		

Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.
4. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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GAS MONITOR - HYDROGEN SULFIDE (H2S)

CLIENT:
Mattamy (Sherwood Park) Ltd.
Strathcona County, AB

PROJECT:
Hearthstone Sanitary Lift Station

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TRANSDUCER	1	Tag No.	**10-AE-703**
	2	Manufacturer	**Honeywell**
	3	Model No.	**XNX EC Series (XNXXSH1SS)**
	4	Type	**Electrochemical cell type detector**
	5	Service	**Hydrogen Sulfide**
	6	Material	**316 SST**
	7	Protection Classification	**CSA Class 1 Div. 2 Group C/D**
	8	Finish	**Electropolished**
	9	Calibrated Measurement Range	**0 to 50 ppm**
	10	Mounting	**Surface mounted (via manufacturer's remote mount kit)**
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TRANSMITTER	21	Tag No.	**10-AIT-703**
	22	Model No.	**XNX EC Series (XNX-UT-SE-RHNNN)**
	23	Mounting	**Surface**
	24	Output(s)	**H2S concentration (continuous), Alarm (multi-point)**
	25	Display / Units	**LCD Backlit** / **ppm**
	26	Area Classification	**CSA Class 1 Div. 2 Group C/D - IP66 rated**
	27	Finish	**Painted**
	28	Power Supply	**24VDC**
	29	Input / Output Signals	**Analog 4-20mA output , relay output contacts (3x N.O./N.C.)**
	30	Enclosure	**316 SST Housing and Fittings**
	31		
	32		
	33		
GENERAL	34	Procurement	**1 - Transducer / Sensor**
	35		**1 - Transmitter**
	36		**1 - Manufacturer's remote sensor mounting kit (c/w cable)**
	37	Accessories	**Installation, Operation and Maintenance Manual**
	38	Alternates	**Equivalent as manufactured by Otis, Sensidyne, Emerson Det-Tronics**
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	42		

Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.
4. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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GAS MONITOR - METHANE (LEL)

CLIENT:
Mattamy (Sherwood Park) Ltd.
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PROJECT:
Hearthstone Sanitary Lift Station

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TRANSDUCER	1	Tag No.	**10-AE-704**
	2	Manufacturer	**Honeywell**
	3	Model No.	**XNX Series Sensor Type MPD-IV1**
	4	Type	**Infrared type detector**
	5	Service	**Methane**
	6	Material	**316 SST**
	7	Protection Classification	**CSA Class 1 Div. 2 Group C/D**
	8	Finish	**Electropolished**
	9	Calibrated Measurement Range	**0 to 100% LEL**
	10	Mounting	**Surface mounted (via manufacturer's remote mount kit)**
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TRANSMITTER	21	Tag No.	**10-AE-704**
	22	Model No.	**XNX MPD Series (XNX-UT-SI-RHIV1)**
	23	Mounting	**Surface**
	24	Output(s)	**Methane LEL concentration (continuous), Alarm (multi-point)**
	25	Display / Units	**LCD Backlit** / **% LEL**
	26	Area Classification	**CSA Class 1 Div. 2 Group C/D - IP66 rated**
	27	Finish	**Painted**
	28	Power Supply	**24VDC**
	29	Input / Output Signals	**Analog 4-20mA output , relay output contacts (3x N.O./N.C.)**
	30	Enclosure	**316 SST Housing and Fittings**
	31		
	32		
	33		
GENERAL	34	Procurement	**1 - Transducer / Sensor**
	35		**1 - Transmitter**
	36		**1 - Manufacturer's remote sensor mounting kit (c/w cable)**
	37	Accessories	**Installation, Operation and Maintenance Manual**
	38	Alternates	**Equivalent as manufactured by Otis, Sensidyne, Emerson Det-Tronics**
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.
4. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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WARNING BEACON - BLUE

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BEACON	1	Tag No.	**10-BCN-701**
	2	Manufacturer	**Federal Signal**
	3	Model No.	**Fireball Series FB2PST-120B**
	4	Type	**Industrial duty, high intensity, strobe warning light**
	5	Service	**Gas detection warning - H2S**
	6	Mounting	**Surface (via wall mount bracket)**
	7	Material	**Zinc die-cast alloy base with impact-resistent fresnel lens (Blue)**
	8	Output(s)	**None**
	9	Protection Classification	**IP66 ingress protection / NEMA 4X Construction**
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**120VAC**
	12	Input / Output Signals	**None**
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GENERAL	34	Procurement	**1 - Strobe Light**
	35		**1 - Wall mount bracket**
	36		**1 - Wire guard**
	37	Accessories	**Installation, Operation and Maintenance Manual**
	38	Alternates	**Equivalent as manufactured by Sensidyne, EATON, Crouse-Hinds**
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Notes:
1. The Instrument shall be CSA Approved.
2. Vendor to fill in remainder of datasheet.
3. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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Hearthstone Sanitary Lift Station

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BEACON	1	Tag No.	**10-BCN-702**
	2	Manufacturer	**Federal Signal**
	3	Model No.	**Electraray Series 151XST-S120B**
	4	Type	**Industrial duty, hazardous location, high intensity, strobe warning light**
	5	Service	**Gas detection warning - H2S**
	6	Mounting	**Surface (via wall mount bracket)**
	7	Material	**Aluminum base with glass lens (blue), and dome guard**
	8	Output(s)	**None**
	9	Protection Classification	**IP66 ingress protection / NEMA 4X Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D - IP66 rated**
	11	Voltage	**120VAC**
	12	Input / Output Signals	**None**
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GENERAL	34	Procurement	**1 - Strobe Light**
	35		**1 - Wall mount bracket**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Sensidyne, EATON, Crouse-Hinds**
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Notes:
1. The Instrument shall be CSA Approved.
2. Vendor to fill in remainder of datasheet.
3. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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WARNING BEACON - RED

CLIENT:
Mattamy (Sherwood Park) Ltd.
Strathcona County, AB

PROJECT:
Hearthstone Sanitary Lift Station

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BEACON	1	Tag No.	**10-BCN-703**
	2	Manufacturer	**Federal Signal**
	3	Model No.	**Electraray Series 151XST-S120R**
	4	Type	**Industrial duty, hazardous location, high intensity, strobe warning light**
	5	Service	**Gas detection warning - LEL (Methane)**
	6	Mounting	**Surface (via wall mount bracket)**
	7	Material	**Aluminum base with glass lens (red), and dome guard**
	8	Output(s)	**None**
	9	Protection Classification	**IP66 ingress protection / NEMA 4X Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D - IP66 rated**
	11	Voltage	**120VAC**
	12	Input / Output Signals	**None**
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GENERAL	34	Procurement	**1 - Strobe Light**
	35		**1 - Wall mount bracket**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Sensidyne, EATON, Crouse-Hinds**
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Notes:
1. The Instrument shall be CSA Approved.
2. Vendor to fill in remainder of datasheet.
3. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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FLOWMETER - ELECTROMAGNETIC

CLIENT:
Mattamy (Sherwood Park) Ltd.
Strathcona County, AB

PROJECT:
Hearthstone Sanitary Lift Station

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FLOWTUBE	1	Tag No.		**10-FE-101**		
	2	Manufacturer		**Endress + Hauser**		
	3	Model No.		**Promag W400**		
	4	Type		**Electromagnetic**		
	5	Service		**Wastewater Discharge**		
	6	Line Size		**250 mm**		
	7	Meter Size		**250 mm**		
	8	Connection	Rating	**Flanged**		**Class 150 lb**
	9	Material		**Carbon Steel Housing**		
	10	Lining Material		**Polyurethane**		
	11	Electrode Design		**Flush / Flat**		
	12	Electrode Material		**316 SST**		
	13	Protection Classification		**General Purpose / Non-classified - IP67 Rated**		
	14	Finish		**Protective Varnish**		
	15	Grounding Rings		**None (N/A)**		
	16	Calibrated Flow Range		**L/s**		
	17					
	18					
	19					
	20					
TRANSMITTER	21	Tag No.		**10-FQIT-101**		
	22	Model No.		**Promag W400**		
	23	Mounting		**Remote mount on wall near PLC cabinet**		
	24	Output(s)		**Flow, Totalization, Status**		
	25	Display	Units	**LCD Backlit**		**L/s**
	26	Area Classification		**General Purpose / Non-classified - IP66/67 Rated**		
	27	Finish		**Coated Aluminum**		
	28	Power Supply		**100-240VAC / 24VAC / 24VDC**		
	29	Input / Output Signals		**Ethernet/IP**		
	30	Enclosure		**NEMA 4X rated**		
	31					
	32					
	33					
GENERAL	34	Procurement		**1 - Flowtube**		
	35			**1 - Transmitter**		
	36			**1 - Manufacturer's remote transmitter cable**		
	37	Accessories		**Installation, Operation and Maintenance Manual**		
	38	Alternates		**No Alternates Specified - alternate vendor product accepted following**		
	39			**written approval by Owner only**		
	40					
	41					
	42					

Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.
4. Flowmeter shall be suitable for zero-length installation (i.e. 0 * pipe dia. upstream / 0 * pipe dia. downstream)

* Design basis. Consultant approved equivalent may be acceptable.

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AIR FLOW SWITCH

CLIENT:
Mattamy (Sherwood Park) Ltd.
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PROJECT:
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FLOW SWITCH	1	Tag No.	**10-FS-1**
	2	Manufacturer	**Johnson Controls**
	3	Model No.	**F262 Series (F262KDH-01C)**
	4	Type	**Paddle operated switch**
	5	Service	**HVAC air flow sensing**
	6	Mounting	**Mount to HVAC duct**
	7	Material	**Stainless steel paddle / Polycarbonate enclosure**
	8	Output(s)	**Air flow (single point)**
	9	Protection Classification	**NEMA 3R Housing**
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**24VDC**
	12	Input / Output Signals	**Contact Output (1-N.O./N.C)**
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GENERAL	34	Procurement	**1 - Air Flow Switch**
	35		
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Penn Controls, McDonnell Miller**
	38		
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Notes:
1. The Instrument shall be CSA Approved.
2. Vendor to fill in remainder of datasheet.
3. Select paddle size in coordination with HVAC duct size, trim paddle as necessary to fit.

* Design basis. Consultant approved equivalent may be acceptable.

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WARNING HORN

CLIENT:
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HORN	1	Tag No.	**10-HRN-701**
	2	Manufacturer	**Federal Signal**
	3	Model No.	**Vibratone Series 350WB-120**
	4	Type	**Electro-mechanical vibration horn**
	5	Service	**Gas detection warning - H2S**
	6	Mounting	**Surface wall mount**
	7	Material	**Die-cast aluminum housing**
	8	Output(s)	**None**
	9	Protection Classification	**IP65 ingress protection / NEMA 4X Construction**
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**120VAC**
	12	Input / Output Signals	**None**
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GENERAL	34	Procurement	**1 - Horn**
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	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Sensidyne, EATON, Crouse-Hinds**
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Notes:
1. The Instrument shall be CSA Approved.
2. Vendor to fill in remainder of datasheet.
3. All equipment that is supplied for the gas monitoring system shall be from a common vendor (transmitter, sensor, warning devices, etc.)

* Design basis. Consultant approved equivalent may be acceptable.

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LEVEL SWITCH

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LEVEL SWITCH	1	Tag No.	**10-LSH-101**
	2	Manufacturer	**Flygt**
	3	Model No.	**ENM-10 EX**
	4	Type	**Float bulb w/ Micro-switch**
	5	Service	**Sanitary Wastewater (Inlet Vault)**
	6	Mounting	**Hanging**
	7	Material	**Conductive Polypropylene/Carbon Black**
	8	Output(s)	**Liquid level**
	9	Protection Classification	**IP66/68 ingress protection**
	10	Area Classification	**CSA Class 1 Div. 1 Group C/D**
	11	Power Supply	**120VAC**
	12	Input / Output Signals	**Contact Output**
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GENERAL	34	Procurement	**1 - Level Switch**
	35		**1- Manufacturer's cable, length as required.**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**No Alternates Specified - alternate vendor product accepted following**
	38		**written approval by Owner only**
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

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LEVEL SWITCH

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LEVEL SWITCH	1	Tag No.	**10-LSH-102**
	2	Manufacturer	**Flygt**
	3	Model No.	**ENM-10 EX**
	4	Type	**Float bulb w/ Micro-switch**
	5	Service	**Sanitary Wastewater (Wetwell)**
	6	Mounting	**Hanging**
	7	Material	**Conductive Polypropylene/Carbon Black**
	8	Output(s)	**Liquid level**
	9	Protection Classification	**IP66/68 ingress protection**
	10	Area Classification	**CSA Class 1 Div. 1 Group C/D**
	11	Power Supply	**120VAC**
	12	Input / Output Signals	**Contact Output**
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GENERAL	34	Procurement	**1 - Level Switch**
	35		**1- Manufacturer's cable, length as required.**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**No Alternates Specified - alternate vendor product accepted following**
	38		**written approval by Owner only**
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

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LEVEL SWITCH

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LEVEL SWITCH	1	Tag No.	**10-LSH-103**
	2	Manufacturer	**Flygt**
	3	Model No.	**ENM-10**
	4	Type	**Float bulb w/ Micro-switch**
	5	Service	**Drywell Flood (floor drain sump)**
	6	Mounting	**Hanging**
	7	Material	**Polypropylene/Blue**
	8	Output(s)	**Liquid level**
	9	Protection Classification	**IP66/68 ingress protection**
	10	Area Classification	**General Purpose / Non-classified**
	11	Power Supply	**120VAC**
	12	Input / Output Signals	**Contact Output**
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GENERAL	34	Procurement	**1 - Level Switch**
	35		**1- Manufacturer's cable, length as required.**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**No Alternates Specified - alternate vendor product accepted following**
	38		**written approval by Owner only**
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

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LEVEL SWITCH

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LEVEL SWITCH	1	Tag No.	**10-LSH-104**
	2	Manufacturer	**Flygt**
	3	Model No.	**ENM-10**
	4	Type	**Float bulb w/ Micro-switch**
	5	Service	**Drywell Flood (weeping tile sump)**
	6	Mounting	**Hanging**
	7	Material	**Polypropylene/Blue**
	8	Output(s)	**Liquid level**
	9	Protection Classification	**IP66/68 ingress protection**
	10	Area Classification	**General Purpose / Non-classified**
	11	Power Supply	**120VAC**
	12	Input / Output Signals	**Contact Output**
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GENERAL	34	Procurement	**1 - Level Switch**
	35		**1- Manufacturer's cable, length as required.**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**No Alternates Specified - alternate vendor product accepted following**
	38		**written approval by Owner only**
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

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LEVEL SWITCH

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LEVEL SWITCH	1	Tag No.	**10-LSL-101**
	2	Manufacturer	**Flygt**
	3	Model No.	**ENM-10 EX**
	4	Type	**Float bulb w/ Micro-switch**
	5	Service	**Sanitary Wastewater (Wetwell)**
	6	Mounting	**Hanging**
	7	Material	**Conductive Polypropylene/Carbon Black**
	8	Output(s)	**Liquid level**
	9	Protection Classification	**IP66/68 ingress protection**
	10	Area Classification	**CSA Class 1 Div. 1 Group C/D**
	11	Power Supply	**120VAC**
	12	Input / Output Signals	**Contact Output**
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GENERAL	34	Procurement	**1 - Level Switch**
	35		**1- Manufacturer's cable, length as required.**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**No Alternates Specified - alternate vendor product accepted following**
	38		**written approval by Owner only**
	39		
	40		
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	42		

Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

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LEVEL TRANSMITTER - RADAR

CLIENT:
Mattamy (Sherwood Park) Ltd.
Strathcona County, AB

PROJECT:
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TRANSMITTER	1	Tag No.		**10-LT-101**		
	2	Manufacturer		**VEGA**		
	3	Model No.		**VEGAFLEX 83**		
	4	Type		**Guided Wave Radar**		
	5	Service		**Sanitary Wet Well**		
	6					
	7	Mounting		**Flange fitting**		
	8					
	9	Material		**316L Stainless Steel**		
	10					
	11	Output(s)		**Level (continuous), Status**		
	12	Electrode Material		**Perfluoroalkoxy (PFA coated)**		
	13	Protection Classification		**IP66/IP67 rated**		
	14	Finish		**Media blasted**		
	15	Display	Units	**None**		**None**
	16	Calibrated Measurement Range		**0 to 11.5 m (+/-2mm accuracy)**		
	17	Area Classification		**General Purpose / Non-classified**		
	18	Power Supply		**24VDC**		
	19	Input / Output Signals		**4-20mA two-wire (loop powered)**		
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	33					
GENERAL	34	Procurement		**1 - Transmitter**		
	35			**1 - Cable probe**		
	36					
	37	Accessories		**Installation, Operation and Maintenance Manual**		
	38	Alternates		**Equivalent as manufactured by Endress + Hauser**		
	39					
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	41					
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.
4. Confirm measurement range with Process drawings, configure cable probe to suit required range, adjust range as required to accommodate dead-band.

* Design basis. Consultant approved equivalent may be acceptable.

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LEVEL TRANSMITTER - RADAR

CLIENT:
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TRANSMITTER	1	Tag No.		**10-LT-102**		
	2	Manufacturer		**VEGA**		
	3	Model No.		**VEGAFLEX 83**		
	4	Type		**Guided Wave Radar**		
	5	Service		**Sanitary Inlet Vault**		
	6					
	7	Mounting		**Flange fitting**		
	8					
	9	Material		**316L Stainless Steel**		
	10					
	11	Output(s)		**Level (continuous), Status**		
	12	Electrode Material		**Perfluoroalkoxy (PFA coated)**		
	13	Protection Classification		**IP66/IP67 rated**		
	14	Finish		**Media blasted**		
	15	Display	Units	**None**		**None**
	16	Calibrated Measurement Range		**0 to 9.5 m (+/-2mm accuracy)**		
	17	Area Classification		**General Purpose / Non-classified**		
	18	Power Supply		**24VDC**		
	19	Input / Output Signals		**4-20mA two-wire (loop powered)**		
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GENERAL	34	Procurement		**1 - Transmitter**		
	35			**1 - Cable probe**		
	36					
	37	Accessories		**Installation, Operation and Maintenance Manual**		
	38	Alternates		**Equivalent as manufactured by Endress + Hauser**		
	39					
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.
4. Confirm measurement range with Process drawings, configure cable probe to suit required range, adjust range as required to accommodate dead-band.

* Design basis. Consultant approved equivalent may be acceptable.

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PRESSURE TRANSMITTER

CLIENT:
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Strathcona County, AB

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TRANSMITTER	1	Tag No.		**10-PIT-101**		
	2	Manufacturer		**VEGA**		
	3	Model No.		**VEGABAR 82 c/w external display (VEGADIS 81)**		
	4	Type		**Gauge Measurement**		
	5	Service		**Sanitary Discharge (Station)**		
	6	Line Size		**200mm**		
	7	Mounting		**Direct-mount on isolation ring**		
	8	Connection	Rating	**1/2-inch - 14 NPT Female**		
	9	Material		**316 SST Housing and Fittings**		
	10	Lining Material				
	11	Output(s)		**Pressure**		
	12	Electrode Material				
	13	Protection Classification		**General Purpose / Non-classified - IP68 Rated**		
	14	Finish		**Media Blasted**		
	15	Display	Units	**LCD**	**psi / kPa**	
	16	Calibrated Pressure Range		**0 to 150 psi (with max. 0.05% accuracy)**		
	17	Area Classification		**General Purpose / Non-classified - IP68 Rated**		
	18	Power Supply		**24VDC**		
	19	Input / Output Signals		**4-20mA two-wire (loop powered)**		
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GENERAL	34	Procurement		**1 - Transmitter**		
	35			**1 - External Display**		
	36			**1 - Manufacturer's remote display cable**		
	37	Accessories		**Installation, Operation and Maintenance Manual**		
	38	Alternates		**Equivalent as manufactured by Rosemount, Siemens, Endress + Hauser**		
	39					
	40					
	41					
	42					

Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

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PRESSURE TRANSMITTER

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Strathcona County, AB

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TRANSMITTER	1	Tag No.		**10-PIT-102**		
	2	Manufacturer		**VEGA**		
	3	Model No.		**VEGABAR 82 c/w external display (VEGADIS 81)**		
	4	Type		**Gauge Measurement**		
	5	Service		**Sanitary Discharge (Pump 1)**		
	6	Line Size		**300mm**		
	7	Mounting		**Direct-mount on isolation ring**		
	8	Connection	Rating	**1/2-inch - 14 NPT Female**		
	9	Material		**316 SST Housing and Fittings**		
	10	Lining Material				
	11	Output(s)		**Pressure**		
	12	Electrode Material				
	13	Protection Classification		**General Purpose / Non-classified - IP68 Rated**		
	14	Finish		**Media Blasted**		
	15	Display	Units	**LCD**	**psi / kPa**	
	16	Calibrated Pressure Range		**0 to 150 psi (with max. 0.05% accuracy)**		
	17	Area Classification		**General Purpose / Non-classified - IP68 Rated**		
	18	Power Supply		**24VDC**		
	19	Input / Output Signals		**4-20mA two-wire (loop powered)**		
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GENERAL	34	Procurement		**1 - Transmitter**		
	35			**1 - External Display**		
	36			**1 - Manufacturer's remote display cable**		
	37	Accessories		**Installation, Operation and Maintenance Manual**		
	38	Alternates		**Equivalent as manufactured by Rosemount, Siemens, Endress + Hauser**		
	39					
	40					
	41					
	42					

Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

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PRESSURE TRANSMITTER

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TRANSMITTER	1	Tag No.		**10-PIT-103**		
	2	Manufacturer		**VEGA**		
	3	Model No.		**VEGABAR 82 c/w external display (VEGADIS 81)**		
	4	Type		**Gauge Measurement**		
	5	Service		**Sanitary Discharge (Pump 2)**		
	6	Line Size		**300mm**		
	7	Mounting		**Direct-mount on isolation ring**		
	8	Connection	Rating	**1/2-inch - 14 NPT Female**		
	9	Material		**316 SST Housing and Fittings**		
	10	Lining Material				
	11	Output(s)		**Pressure**		
	12	Electrode Material				
	13	Protection Classification		**General Purpose / Non-classified - IP68 Rated**		
	14	Finish		**Media Blasted**		
	15	Display	Units	**LCD**	**psi / kPa**	
	16	Calibrated Pressure Range		**0 to 150 psi (with max. 0.05% accuracy)**		
	17	Area Classification		**General Purpose / Non-classified - IP68 Rated**		
	18	Power Supply		**24VDC**		
	19	Input / Output Signals		**4-20mA two-wire (loop powered)**		
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GENERAL	34	Procurement		**1 - Transmitter**		
	35			**1 - External Display**		
	36			**1 - Manufacturer's remote display cable**		
	37	Accessories		**Installation, Operation and Maintenance Manual**		
	38	Alternates		**Equivalent as manufactured by Rosemount, Siemens, Endress + Hauser**		
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Notes:
1. The Instrument shall be CSA Approved.
2. Supply instrument with permanently afixed 316 stainless steel tag, stamped with tag number.
3. Vendor to fill in remainder of datasheet.

* Design basis. Consultant approved equivalent may be acceptable.

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PILOT LIGHT - RED

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Strathcona County, AB

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Hearthstone Sanitary Lift Station

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PILOT LIGHT	1	Tag No.	**10-PL-1**
	2	Manufacturer	**Allen Bradley**
	3	Model No.	**800H-QRTH2R**
	4	Type	**Industrial duty, push-to-test, LED pilot light**
	5	Service	**Ventilation Failure warning**
	6	Mounting	**Surface mount control station enclosure**
	7	Material	**Pilot light: plastic body and lens (red) / Enclosure: thermoplastic body**
	8	Output(s)	**None**
	9	Protection Classification	**IP66 ingress protection / NEMA 4X Construction**
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**120VAC**
	12	Input / Output Signals	**None**
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GENERAL	34	Procurement	**1 - Pilot Light**
	35		**1 - Enclosure**
	36		**1 - Warning Label**
	37	Accessories	**Installation, Operation and Maintenance Manual**
	38	Alternates	**Equivalent as manufactured by Schneider/Square-D, EATON**
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Notes:
1. The Instrument shall be CSA Approved.
2. Vendor to fill in remainder of datasheet.
3. Refer to drawings for warning label requirements

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SMOKE / HEAT DETECTOR

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DETECTOR	1	Tag No.	**10-TSH-701**
	2	Manufacturer	**Edwards Signalling**
	3	Model No.	**500 Series (521NCRXT)**
	4	Type	**Photoelectric smoke, fixed temperature, and rate-of-rise heat**
	5	Service	**Smoke and Heat detection**
	6	Mounting	**Surface**
	7	Material	
	8	Output(s)	**Alarm (Smoke / Heat)**
	9	Protection Classification	
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**24VDC**
	12	Input / Output Signals	**Contact Output (1-N.O./N.C)**
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GENERAL	34	Procurement	**1 - Detector**
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	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Honeywell, Siemens**
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Notes:
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TEMPERATURE TRANSMITTER

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TRANSMITTER	1	Tag No.		**10-TT-701**		
	2	Manufacturer		**Endress + Hauser**		
	3	Model No.		**TMR31**		
	4	Type		**RTD Pt100**		
	5	Service		**Building Air Temperature**		
	6	Probe size		**30mm length, 6mm diameter**		
	7	Mounting		**NPT 1/2 male thread ANSI, 316L**		
	8					
	9	Material		**304 SST Housing**		
	10	Lining Material				
	11	Output(s)		**Temperature**		
	12	Probe Material		**316 SST**		
	13	Protection Classification		**General Purpose / Non-classified - IP66/67 Rated**		
	14	Finish				
	15	Display	Units	**None**		**None**
	16	Calibrated Range		**-50 to +150°C**		
	17	Area Classification		**General Purpose / Non-classified - IP66/67 Rated**		
	18	Power Supply		**24VDC**		
	19	Input / Output Signals		**4-20mA loop powered**		
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GENERAL	34	Procurement		**1 - Transmitter**		
	35					
	36	Accessories		**Installation, Operation and Maintenance Manual**		
	37	Alternates		**Equivalent as manufactured by Rosemount, Siemens, WIKA**		
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Notes:
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DOOR LIMIT SWITCH

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LIMIT SWITCH	1	Tag No.	**10-ZSO-702A**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802T-APD**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, Oil-tight switch.**
	5	Service	**Instrusion detection - man door**
	6	Mounting	
	7	Material	
	8	Output(s)	**Door position (open/close)**
	9	Protection Classification	**IP67 ingress protection / NEMA 4/13 Construction**
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O. & 1-N.C)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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DOOR LIMIT SWITCH

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LIMIT SWITCH	1	Tag No.	**10-ZSO-702B**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802T-APD**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, Oil-tight switch.**
	5	Service	**Instrusion detection - man door**
	6	Mounting	
	7	Material	
	8	Output(s)	**Door position (open/close)**
	9	Protection Classification	**IP67 ingress protection / NEMA 4/13 Construction**
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O. & 1-N.C)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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ACCESS HATCH LIMIT SWITCH

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LIMIT SWITCH	1	Tag No.	**10-ZSO-703A**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802X-AF7**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, sealed contact switch.**
	5	Service	**Instrusion detection - wetwell hatch**
	6	Mounting	
	7	Material	
	8	Output(s)	**Hatch position (open/close)**
	9	Protection Classification	**NEMA 7/9 Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O., operates/closes when lever moves clockwise or counterclockwise)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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LIMIT SWITCH	1	Tag No.	**10-ZSO-703B**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802X-AF7**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, sealed contact switch.**
	5	Service	**Instrusion detection - wetwell hatch**
	6	Mounting	
	7	Material	
	8	Output(s)	**Hatch position (open/close)**
	9	Protection Classification	**NEMA 7/9 Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O., operates/closes when lever moves clockwise or counterclockwise)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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LIMIT SWITCH	1	Tag No.	**10-ZSO-703C**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802X-AF7**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, sealed contact switch.**
	5	Service	**Instrusion detection - wetwell hatch**
	6	Mounting	
	7	Material	
	8	Output(s)	**Hatch position (open/close)**
	9	Protection Classification	**NEMA 7/9 Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O., operates/closes when lever moves clockwise or counterclockwise)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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Notes:
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LIMIT SWITCH	1	Tag No.	**10-ZSO-703D**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802X-AF7**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, sealed contact switch.**
	5	Service	**Instrusion detection - wetwell hatch**
	6	Mounting	
	7	Material	
	8	Output(s)	**Hatch position (open/close)**
	9	Protection Classification	**NEMA 7/9 Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O., operates/closes when lever moves clockwise or counterclockwise)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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Notes:
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LIMIT SWITCH	1	Tag No.	**10-ZSO-703E**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802X-AF7**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, sealed contact switch.**
	5	Service	**Instrusion detection - wetwell hatch**
	6	Mounting	
	7	Material	
	8	Output(s)	**Hatch position (open/close)**
	9	Protection Classification	**NEMA 7/9 Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O., operates/closes when lever moves clockwise or counterclockwise)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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Notes:
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LIMIT SWITCH	1	Tag No.	**10-ZSO-703F**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802X-AF7**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, sealed contact switch.**
	5	Service	**Instrusion detection - wetwell hatch**
	6	Mounting	
	7	Material	
	8	Output(s)	**Hatch position (open/close)**
	9	Protection Classification	**NEMA 7/9 Construction**
	10	Area Classification	**CSA Class 1 Div. 2 Group C/D**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O., operates/closes when lever moves clockwise or counterclockwise)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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LIMIT SWITCH	1	Tag No.	**10-ZSO-704**
	2	Manufacturer	**Allen-Bradley**
	3	Model No.	**802T-APD**
	4	Type	**Heavy-duty, Roller-lever operated, Spring return, Oil-tight switch.**
	5	Service	**Instrusion detection - man door**
	6	Mounting	
	7	Material	
	8	Output(s)	**Door position (open/close)**
	9	Protection Classification	**IP67 ingress protection / NEMA 4/13 Construction**
	10	Area Classification	**General Purpose / Non-classified**
	11	Voltage	**24VDC or 120VAC**
	12	Input / Output Signals	**Contact Output (1-N.O. & 1-N.C)**
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GENERAL	34	Procurement	**1 - Limit Switch**
	35		**1 - Lever Operator (316SST, adjustable)**
	36	Accessories	**Installation, Operation and Maintenance Manual**
	37	Alternates	**Equivalent as manufactured by Schneider/SquareD, EATON/Moeller**
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2.7 Software

.1 PLC Programming Software

.1 <TBD>

.2 HMI Programming Software

.1 <TBD>

.3 SCADA Programming Software

.1 <TBD>

.4 HMI Mobile Devices Programming Software

.1 <TBD>

.5 Historian Software

.1 <TBD>

Part 3 EXECUTION

3.1 Pumpstation Operation Overview

.1 General

.1 The Contractor shall refer to the detailed Control Narrative document, separate from this specification, for a full explanation of the operation of the system. Should there be a discrepancy between the information described in this specification and the Control Narrative, the Control Narrative shall take precedence.

.2 The pump station will be given the command to pump from wastewater level values as read by the measuring devices, in accordance with process target values and values obtained through communication with upstream and downstream stations if applicable.

.3 Note: Contractor shall confirm the actual process values with the Owner's Representative responsible for process design.

.2 Emergency Stop

.1 Each pump shall have an emergency stop push button located on the front of its respective controller in the MCC to allow for a hard shutdown of the pump in the case of an emergency

.3 Waste Water Pumping Process:

.1 Pumping of water will not be permitted unless a permission to run signal has been received from the station's PLC. The PLC shall monitor level and flow values as well as signals received via SCADA to determine if pumping is permitted.

.2 The wetwell contains two pumps configured in a duty/standby configuration.

.3 The normal operation of the process is to take the wet well level from the level transmitter. If the measured level is above the pump start value, then the PLC shall initiate starting of the duty pump. If the level continues to rise past the alarm level the PLC shall initiate an alarm through the SCADA system. When the level decreases below the pump stop level the PLC shall initiate the stop signal for the duty pump. Actual level values are to be determined by the Owner's Representative responsible for process design.

.4 If the duty pump fails to operate, the PLC shall issue an alarm and send a start command to the standby pump.

.5 Should the PLC receive a loss of echo alarm from the level transmitter the PLC shall issue an alarm via SCADA. The pump station shall continue to operate using level signals from the float bulbs in the wet well. Two float bulbs shall be used to determine the operation for duty pump start and duty pump stop.

.4 Hand-Off-Auto (HOA) Operation of the Pumps:

.1 When in HAND position, the VFD will run. It is to ignore all signals from the PLC. It is intended for pure manual operation, with the operator having complete control over all functions.

.2 When in OFF position, the VFD will not run at all, and the PLC is to issue a Pump Unavailable to Run alarm/warning.

.3 When in the AUTO position, the VFD will ignore all local controller button depressions, apart from the emergency stop, and rely only on signals from the PLC to dictate its running characteristics.

.4 If the VFD is unable to power the pump motor due to failure, the VFD will send an alarm signal and the PLC will initiate the alarm.

.5 PLC Operation of the Pumps:

.1 When under PLC control the pumps shall operate via Ethernet communication to run or stop and collect status information.

.2 If the PLC monitoring relay indicates PLC loss of operation the pumps shall be stopped and operated from the level transmitter. The level transmitter should be hard wired into the pump soft starts in case of a PLC failure.

.3 During normal operation the PLC is to keep a running total of the run time of each pump and automatically swap the pumps designated as ’Duty’ and ‘Standby’ after each pump cycle.

.6 General Operations

.1 The PLC shall monitor the door switch(es) as an intruder alarm. An indicator light on the PLC control panel shall indicate the status of the alarm (armed/disarmed).

.2 The PLC shall monitor the building temperature transmitter and issue an alarm if the temperature falls outside of the respective limits.

.3 The PLC shall monitor the health of the MCC surge protective device and issue an appropriate alarm should it fail.

.4 The PLC is to monitor the building heat detectors and issue an alarm should the heat detector become activated. The pumps will also be blocked from operation.

.5 The PLC is to monitor the building HVAC ventilation flow switch(es) and issue an alarm should the flow switch activate.

.6 The PLC is to monitor the health of the UPS and its charging system. Set up the UPS with the relay interface card as shown in the drawings, with a contact for each condition to change state respectively and the PLC to issue an alarm.

.7 The PLC is to monitor the digital power meter in the MCC which will communicate relevant parameters of the electrical distribution system.

.8 The PLC shall monitor the power fail relay (PFR) and issue an alarm if the PFR detects a loss of utility power.

.9 The PLC shall monitor the automatic transfer switch (ATS) and issue alarms when the ATS detects a loss of utility power and when the ATS is connected to standby generator power.

.10 The PLC shall monitor the standby generator and issue alarms when the generator is running and when the generator common alarm is activated.

3.2 HMI Setup, Operation, and Screen Development:

.1 Contractor shall program the HMI station and create the HMI screens for the Pump Station.

.2 The contractor shall supply HMI software.

.3 HMI System – Using the information in the PLC, program the HMI to display the following screens.

.1 Summary Status Screen:

.1 Default screen of HMI; after five minutes of inactivity, the HMI will show this screen.

.2 The screen shows its title at the top of the screen.

.3 This screen shows the wet well levels, discharge flows, all pump status', individual pump total running time, number of alarms present.

.4 The screen should be a representation of the station layout showing equipment in their approximate locations.

.5 Equipment should be colored red in a run or activated state and green in a stopped or deactivated state.

.6 The discharge flow rate (L/s) should be displayed on the HMI numerically.

.7 Pump run time shall be displayed in hours for each pump.

.8 This screen shows the current time and date.

.9 This screen is viewable with the push of a touch screen button displayed on all screens.

.10 This screen is automatically updated to show current status at all times.

.2 Alarm Screen:

.1 This screen shows its title at the top of the screen.

.2 This screen shows the listing of all alarms either acknowledged or new. Provide scroll up and down function keys.

.3 Configure the alarm list chronologically with the most recent alarm on top of the list.

.4 All alarms to be time and date stamped when received in the PLC to the nearest tenth of a second.

.5 When a new alarm is received, the text of the new alarm will flash at a rate of one flash per second.

.6 Provide two touch screen buttons to operate as reset and acknowledge push buttons.

.7 Acknowledge pushbutton to convert new alarms to acknowledged alarms and make text of acknowledged alarms stop flashing.

.8 Reset push button to remove from the alarm screen those alarms whose field condition is no longer in alarm state.

.9 This screen is viewable with the push of a touch screen button.

.10 This screen shows the current time and date.

.11 Program the PLC to recognize and the HMI to display the following Preliminary Alarm List:

.1 Waste Water Pump #1 Failed. Fault Alarms:

.1 communication to PLC lost

.2 failed to start

.3 ground fault
.4 jammed
.5 over current
.6 phase unbalanced
.7 stalled

.2 Waste Water Pump #2 Failed. Fault Alarms:
.1 communication to PLC lost
.2 failed to start
.3 ground fault
.4 jammed
.5 over current
.6 phase unbalanced
.7 stalled

.3 Waste Water Pump #1 Motor Failed Temperature High
.4 Waste Water Pump #2 Motor Failed Temperature High
.5 Waste Water Pump #1 Motor Stator Leakage
.6 Waste Water Pump #2 Motor Stator Leakage
.7 Waste Water Pump #1 Unable to Run (HOA switch in “off”)
.8 Waste Water Pump #2 Unable to Run (HOA switch in “off”)
.9 Discharge Flow Meter Loss of Signal Alarm
.10 Wet Well Level Transmitter Loss of Echo Alarm
.11 Utility Power Failure
.12 PLC Cabinet Surge Protection Failure
.13 MCC Surge Protection Failure
.14 Heat Detector High Alarm
.15 Low Building Temp
.16 High Building Temp
.17 Ventilation Failure
.18 UPS – Line Failure
.19 UPS – Battery Low
.20 UPS – On/OK
.21 UPS – Normal/On Inverter
.22 Intruder Alarms (as many as shown on drawings)
.23 Power Fail Relay – Loss of Utility Power
.24 Generator – Failed to Start (overcrank)
.25 Generator – Running
.26 Auto transfer Switch – Connected to Generator
.27 PLC Failure

.3 HMI Screens Information Screen:
.1 This screen shows its title at the top of the screen.
.2 This screen shall be used to show additional information not shown in the Summary Status Screen.
.3 This screen is viewable with the push of a touch screen button.
.4 This screen shows the current time and date.

.4 Control Action Screen:

.1 This screen shows its title at the top of the screen.

.2 Screen shall show and describe actions to be taken after an alarm occurs.

.3 This screen shall show and describe actions to be taken regarding changes to be made to the process to maintain optimum operation of the facility.

.4 This screen is viewable with the push of a touch screen button.

.5 This screen shows the current time and date.

.5 Security Alarm Screen:

.1 This screen shows its title at the top of the screen.

.2 This screen will allow the operator to enter in the four-digit alarm code. If the wrong code is entered the HMI is to ask to re-enter the code.

.3 This screen to allow for reprogramming of the security code only after the alarm has been de-activated.

.4 This screen is to display status of the alarm, whether it is activated or inactivated.

.5 The screen is automatically updated to show current status at all times.

.6 Upon entrance into the station, a screen will be displayed on the HMI asking for the intruder alarm disable security code. This screen will disappear once the correct code is entered. The screen to show a countdown of the time remaining before the intruder alarm will go off.

.7 Program a function key to show a screen on the HMI that allows the intruder alarm to be re-activated. The screen to show the countdown of the time remaining before the intruder alarm will be re-activated.

.8 This screen is viewable with the push of a touch screen button.

.9 This screen shows the current time and date.

.4 Mock-up Screens:

.1 The contractor shall initiate a kick-off meeting or telephone conference to discuss the HMI screen development with the Owner's Representative. True color samples to be provided at the meeting by the Contractor.

.2 The Contractor is to provide colour copies of the proposed HMI screens for review and comment by the Owner's Representative.

.3 After the initial and each subsequent review of the HMI screens by the Owner's Representative, the Contractor shall revise and resubmit mock-up screens until accepted.

.5 Integration with SCADA

.1 The SCADA system is to be connected to the existing SCADA back haul network as shown on the drawings via cellular modem.

.2 Communication to the station should be done by VPN tunnel. Only allow communication between County Operations and the Pump Station, ignoring all commands or statuses from any other IP address' other than those coming from County Operations and a hard-wired connection to a programmer's laptop in the lift station.

.3 The station SCADA system shall be compatible with the existing SCADA back haul network.

.4 All alarms displayed on the HMI are to be transmitted via the SCADA system to County Operations.

.5 Contractor to coordinate programming of new screen(s) on the County Operations SCADA system to show all status' as shown on the HMI as well as all alarms.

.6 Operator at County Operations should have the ability to acknowledge all alarms from the Pump Station on the SCADA screen(s).

3.3 Installation:

.1 Instrumentation

.1 All control and instrumentation devices shall be installed according to manufacturer's instructions.

.2 Should there be a conflict between the contract documents and the manufacturer's instructions; the manufacturer's instructions shall apply.

.3 Provide necessary plumbing connections and fixtures to obtain optimum performance of the instrumentation.

.4 Program, set-up, calibrate, and test all instrumentation devices for optimum performance in the shown application. Provide manufacturer's representative to be on-site for these purposes. Minimum on-site duration is one day per instrument.

.5 Train owner's operations staff in the use of all instrumentation devices. Manufacturer's representative to be on-site for this purpose. Minimum on-site duration is one day, separate from that of those tasks listed during programming and calibration.

.6 Co-ordinate all onsite time with the Owner's Representative who may wish to attend the site sessions and ask questions to the representatives.

.7 Manufacturer's technical representative for all instrumentation to be on site for the commissioning process. Allow for one day, separate trip from that of set-up and training.

.2 PLC

.1 Installation and Wiring

.1 Wire all PLC I/O to terminal blocks as shown on the drawings.

.2 All control wiring shall be #16 AWG, TEW wire, with appropriate fuse protection.

.3 Auxiliary control relays, if required, shall be Omron, Potter-Brumfield, or Allen-Bradley of the octal-base type, 8-pin, general-purpose relay, with a minimum contact rating of 10 amps.

.4 Time delay relays, if required, shall be Omron Type H3BA, or Allen Bradley, or an approved equivalent industrial grade.

.5 Indicating lights, pushbuttons, and selector switches, where required, shall be 800T style, 30.5 mm, as manufactured by Allen-Bradley

.2 Field Wiring Checking for PLC

.1 Contractor to provide a qualified assistant to the PLC programmer to ensure that all field contacts are correctly connected to PLC inputs and outputs.

.2 Allow 10 man-days of wiring checks with the PLC programmer.

.3 Toggle all field contacts to ensure all inputs are recognized by the PLC as they change state.

.4 The PLC programmer will force outputs to ensure they energize field devices.

.5 The PLC programmer will simulate all 4-20mA signals to ensure their continuity.

.6 After all inputs and outputs are functional, inform the Owner's Representative who will come to site and witness the functional operation of all I/O.

.3 Communications

.1 All communication network equipment shall be installed and configured as recommended by the Owner's Representative.

.2 All fiber and copper connections shall be tested and verified.

.3 Confer with the Owner's Representative and system integrator for any questions related to the communication network design.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

1.3 System

.1 See drawings for electrical details.

Part 2 PRODUCTS

2.1 General

.1 As noted herein, except where specifically noted otherwise.

.2 Transformers: 60 Hz, delta, three phase and four wire grounded star, air cooled type natural circulation in ventilated metal case to CSA and CEMA standards, with temperature rise rating of 115°C, 10kV BIL.

.3 Provide four (4) full capacity taps; at 2.5% increments, two (2) above and two (2) below nominal operating voltage.

.4 Temperature gauges:

.1 On transformers 300 kVA and larger, provide temperature gauge reading core and coil temperature. Gauge to have alarm contacts.

.5 Dry type transformers shall be HPS Sentinel energy efficient series as manufactured by Hammond, or equivalent by EATON, Square D.

Part 3 EXECUTION

3.1 Mounting

.1 Transformers: floor mounted on 100mm high concrete housekeeping base and/or wall hung as noted, 150 mm clear of wall, complete with vibration isolation dampers.

3.2 Installation

.1 Connections to transformers shall be made using flexible conduit. TECK cable may connect directly to transformer.

3.3 Testing

.1 Refer to Section 26-08-10 – Electrical Starting and Testing – General Requirements.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

1.3 Design

.1 Construct panelboards to CSA Standards.

Part 2 PRODUCTS

2.1 Panels

.1 Panels: Surface or flush mounted as indicated complete with panel trim having concealed hinges and trim mounting screws, hinged locking door with flush catch. EEMAC 1 enclosure.

.2 Provide two (2) keys for each panel, interchangeable with panels of same voltage.

.3 Copper bussing, full capacity neutral.

.4 Separate ground bar.

2.2 120/208V, 120/240V AND 347,600V PANELBOARDS

.1 Panelboards: 3-phase, 4-wire, solid neutral design with sequence style housing of capacity indicated, composed of an assembly of bolt-in-place molded case automatic air circuit breakers as indicated with the thermal and magnetic trip and trip free position separate from either the "On" or "Off" positions. Multi-pole breakers (i.e., 2-pole and/or 3-pole units) to have common simultaneous trip. Interrupting rating of 10kA or as noted.

.2 Complete with main breaker as noted.

2.3 Manufacturers

.1 347/600 Volt Panelboards

.1 Provide EATON Pow-R-Line C type PRL2A panelboard or equivalent as manufactured by Schneider/Square D, or Siemens.

.2 120/208 Volt and 120/240 Volt Panelboards.

.1 Provide EATON Pow-R-Line C type PRL1A panelboard or equivalent as manufactured by Schneider/Square D, or Siemens.

Part 3 EXECUTION

3.1 Installation

.1 Provide all mounting brackets, busbar and drillings and filler pieces for spaces.

.2 Provide an accurate and neatly typewritten directory for each panel. Use the directory provided by the manufacturer and note loads in numerical order with odd numbered circuits on the left side and even numbered circuits on the right side. Note all loads, spares, and spaces.

.3 Refer to drawings for voltage, phase, ampacity, and size.

.4 Breakers applied for series rating are not acceptable.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Supplementary Conditions	Section 00-73-00
.2	Electrical General Requirements:	Section 26-00-10
.3	Identification for Electrical Systems:	Section 26-05-53
.4	Electrical Starting and Testing – General Requirements:	Section 26-08-10
.5	Control, Instrumentation, SCADA, Communication Network	Section 26-09-00
.6	Motor Starters/Contactors and Relays:	Section 26-29-13
.7	Variable Speed Drives	Section 26-29-23
.8	Automatic Transfer Switch	Section 26-32-91

1.3 Description

.1 Provide MCC’s as shown on drawings and as specified herein complete with components and features noted.

.2 See drawings for electrical characteristics.

1.4 Source of Supply

.1 All motor control centre line-ups and associated low voltage switchgear sections shall be of one common manufacturer.

Part 2 PRODUCTS

2.1 Components and Features

.1 Unit Motor Control Centres: 600V, 3-phase, Class 1, Type B, dead front, multi-unit control centre type consisting of an assembly of vertical stacks containing the necessary cubicles, housing combination starters, circuit breakers, relays, control terminal section, VFD's, metering, surge protective device(s), filters, transfer switch, etc. and spaces as indicated with blank doors. MCC to be front unit mounting only with a depth of 508 mm.

.2 Bussing: Tin plated copper, braced to withstand short circuit currents of 42 kA RMS symmetrical at 600V, with horizontal bussing, vertical bussing down each stack and barriered. Wiring gutters across top and bottom and vertically down each stack. Provision for adding additional sections.

.3 Manufactured to NEMA/EEMAC Standards. (IEC ratings are not acceptable).

.4 MCC sections shall be arranged in a straight alignment as shown on the drawings. The front of all MCC sections shall form a continuous straight line with corner sections as required. All units shall be suitable for front access. Constructed as EEMAC Type 1 enclosure but with gaskets.

.5 Provide lugs for incoming cables.

.6 Provide a bottom mounted horizontal ground bus 6 mm x 50 mm. Continue the ground bus into all cells in line-up, whether MCC or miscellaneous cells. Provide three (3) mechanical lugs for copper ground conductors (size as required).

.7 The main breakers and feeder breakers (as noted) are to be standard molded case with thermal and magnetic trip elements. Main breakers to have adjustable magnetic trip settings (Long, Short, and Instantaneous at minimum).

.8 Provide all spaces complete with bussing hardware and other accessories required for combination starter units. Provide barriers to isolate the space from all bus work. Provide front-hinged doors throughout, including but not limited to, breakers, starters, transition section, metering, etc. Rear panels may be bolted and unhinged.

.9 All joints and connections to be tin plated, cadmium plate all bolts, nuts, and lock washers to resist corrosion.

.10 Provide lamacoid nameplates identifying loads. Note name and equipment number (when applicable). Refer to section 26-05-53 – Identification for Electrical Systems.

.11 Interconnect digital meters and terminate at one location for field connection (when applicable).

.12 Vertical mounted ground bus for ground stab connection to each plugin starter or breaker assembly.

.13 Dead front construction with shutters when plug in unit is removed.

.14 Feeder breakers to have thermal magnetic trips (unless otherwise noted) and be complete with external lockable operating handle.

.15 Provide a metal horizontal bottom shelf plate within each vertical MCC section.

.16 See drawings for section width for the various components.

2.2 Digital Power Metering

.1 Digital metering to record line load, power quality, and all electrical parameters on the MCC main incoming bus as detailed on drawings and as specified elsewhere.

.2 Provide CT test block and meter.

.3 Test block shall be ABB type FT-1.

.4 The Digital Power Meter (DPM) shall be one of the following to match the supply of the MCC:

- .1 Schneider Electric PowerLogic PM5000 Series;
- .2 Allen-Bradley Powermonitor 5000 series (1426-M6); or,
- .3 approved equivalent as manufactured by EATON.

.5 Provide DPM complete with a display screen (integral or remote) mounted on the front door of the MCC/switchgear compartment.

.6 At a minimum, the DPM must have the following capability and functionality:

- .1 Monitoring of power system via
  - .1 4-voltage sensing inputs; and,
  - .2 4-current sensing inputs
- .2 Measurement of system parameters
  - .1 Current
  - .2 Voltage
  - .3 Frequency

.4 Power factor

.5 Energy

.6 Active and reactive power

.3 Power quality analysis (sag/swell, harmonics to 63rd order, transients)

.4 Graphical LCD display capable of showing and accessing:

.1 Real-time measured values (Volts, Amps, kW, kVA, kVAR, Hz, power factor)

.2 Demand measurements (present, last and peak for Amps, kW, kVA, kVAR)

.3 Energy consumption (kWH, kVAH, kVAR)

.4 Power factor (present, min, max)

.5 Power quality (individual harmonics, total harmonic distortion, total demand distortion)

.6 Waveform capture

.7 DPM configuration settings

.5 Network communication

.1 Refer to and comply with the Section 26 09 00 (Control, Instrumentation, SCADA, Communication Network) for communication requirements specific to the DPM.

.2 Provide the DPM with either inherent communication capability or appropriate communication module(s) as necessary to meet the network connectivity requirements listed within Section 26-09-00.

.7 Install meter within the MCC between 1200mm and 1500mm high.

2.3 Surge Protection Device (SPD)

.1 Include mounted within the MCC, a surge protection device (SPD) as detailed on the drawings.

.2 Provide the SPD c/w 3-phase wye connection, fault indication (1-light per phase), form C alarm contact, audible alarm with reset pushbutton, transient counter, push-to-test, power quality meter, LCD display/HMI

.3 SPD to be constructed and tested in accordance with UL1449 (5th Edition) “Standard for Safety, Surge Protective Devices” and suitable for Type 2 use.

.4 Provide Schneider Electric / Square D ‘Surgelogic’ series SPD unit with a minimum surge rating of 240 kA/phase. Equivalent as manufactured by Allen-Bradley, EATON, or Seimens are acceptable.

2.4 Variable Frequency Drives (VFDs)

.1 Install VFDs of required size as noted

.2 VFDs shall be one of the following to match the supply of the MCC:

.1 Schneider Electric Altivar series;

.2 Allen-Bradley Powerflex series; or,

.3 approved equivalent as manufactured by EATON.

.3 Provide HMI, communications, LCD display and auxiliary contacts.

.4 Each VFD section shall be equipped with ventilation fans and louvers to provide air circulation and cooling to all components within the enclosed unit.

.5 Provide fan assisted cooling on the front of each VFD enclosure.

.1 Size and quantity of fans to be as required to ensure adequate cooling and air flow.

.2 Each fan assembly shall be provided complete with field replaceable filter media.

.3 The filter media shall be easily replaceable from the outside of the enclosure via hinged cover (or equivalent) without requiring personnel to access the interior of the cabinet.

.4 Fans to be rated for operation on 120VAC from the VFD control power circuit and suitable for operation via thermostat.

.6 Manufacturer to provide startup and commissioning services.

.7 See Section 26-29-23 Variable Speed Drives

2.5 Reduced Voltage Soft Starters (RVSS)

.1 Install RVSS of required size as noted.

.2 Provide HMI, communications, LCD display and auxiliary contacts

.3 Manufacturer to provide startup and commissioning services.

.4 See Section 26-29-13 Motor Starters, Contactors, and Relays.

2.6 Communications Interface

.1 Refer to Section 26-09-00 for communication requirements specific to equipment in MCC's.

Part 3 EXECUTION

3.1 Installation

.1 Some re-arrangement of compartments is permitted from that indicated to suit manufacturer's standards provided that the re-arrangement gives approximately the spaces shown on the drawings.

.2 Lace all conductors with nylon ties.

.3 Install MCC level, plumb and square.

.4 Bolt to concrete housekeeping pad.

.5 Carefully coordinate required floor openings.

.6 Set overload relays to match motor current.

.7 Correctly set overcurrent settings for breaker in each starter.

.8 Where applicable, install ventilation/cooling fans to VFD sections to ensure VFD's do not exceed recommended maximum temperature. All ventilation/cooling fans shall have provision for field replaceable filter media and be provided with spare filters. Prior to system turnover to the Owner, all filter media shall be replaced.

3.2 Manufacturer

.1 Supply of motor control centre line-up(s) and associated low voltage switchgear sections shall be from the following manufacturers:

.1 Schneider/Square D (Model 6)

.2 Allen-Bradley (Centerline 2100)

.3 Eaton (Freedom 2100)

3.3 Testing

.1 Refer to Section 26-08-10 - Electrical Testing – General Requirements.

3.4 Nameplates

.1 Install lamacoid nameplate for each MCC noting project name, date of installation, electrical consultant, and electrical contractor.

.2 Install lamacoid nameplate for each load and device.

3.5 Spare Limiters

.1 Provide two (2) sets of 3-phase current limiters of each size and type utilized (when applicable).

3.6 Warranty

.1 Provide a 2-year basic warranty.

.2 Refer to and comply with Section 00 73 00 (Supplemental Conditions).

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

1.3 Source Of Supply

.1 All cabinets and enclosures shall be by a single manufacturer.

.2 Cabinets to be similar in design, appearance and to have the same latches.

1.4 Coordination

.1 Coordinate size and depth of cabinets and enclosures with systems specified in other sections, which require enclosures and as specified.

Part 2 PRODUCTS

2.1 Cabinets And Enclosures

.1 Cabinets and Enclosures:

- .1 Material: PVC, fiberglass, stainless-steel, sheet steel
- .2 Finish: grey (PVC, fiberglass, sheet steel), natural brushed (stainless-steel).
- .3 Covers: hinged, gasketed.
- .4 Hinges: continuous type.
- .5 Latches: stainless steel single handle latch, lockable
- .6 Interior back plates.

.2 Terminal Strips: 250-volt and 600-volt screw terminal types, barriers between terminals, modular, rail mounted.

.3 Indoor cabinets shall be waterproof and dust tight, NEMA, Type 12 of sheet steel.

.4 Outdoor cabinets shall be stainless-steel construction, waterproof, dust tight and corrosion resistant of NEMA Type 4X.

- .1 Provide outdoor enclosures with insulation and heaters as required for protection from extreme cold temperature along with air vents for protection from extreme heat buildup.

.5 Telephone Cabinet: as other cabinets but with interior 12 mm plywood backboard.

Part 3 EXECUTION

3.1 Installation

.1 Install surface or flush mounted cabinets at locations and heights indicated on drawings.

.2 Use Weidmuller Type SAK terminal blocks for control system terminations.

.3 Install 50% spare terminals at each location.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

1.3 Source Of Supply

.1 Each of the following shall be by a single manufacturer.

.1 All Switches.
.2 All Receptacles.
.3 All Plates.

1.4 Coordination

.1 Coordinate installation of wiring devices and cover plates with site painting and finishing work.

Part 2 PRODUCTS

2.1 Line Voltage Switches

.1 Rating: except where otherwise indicated or specified, 15A, 120V, full load rated.

.2 Toggle, quiet action.

.3 Specification grade.

.4 Features:

.1 Totally enclosed, two (2) piece phenolic case.
.2 Large silver cadmium oxide contacts.
.3 Rust resistance continuous steel mounting strip.
.4 Captive mounting screws.
.5 Large head terminal screws.
.6 Ivory finish.
.7 Hubbell No. 1201, Leviton, Pass and Seymour, Arrow-Hart, G.E., Daniel Woodhead, Bryant.
.8 With pilot light feature (when noted).

2.2 Receptacles

.1 General Purpose Receptacles:

.1 Rating: 20A, 125V except where otherwise indicated.
.2 Configuration: 2-pole, 3-wire grounding, EEMAC 5-20R duplex.
.3 Ground terminal and poles connected to continuous mounting yoke.
.4 Wiring terminals, 2 per side.

.5 Split feed operation, nylon face.

.6 Double wipe heavy phosphor bronze contacts.

.7 Specification grade.

.8 Hubbell No HBL5352 heavy-duty type, or equivalent as manufactured by Legrand, Leviton, Pass & Seymour, Arrow-Hart, G.E., Daniel Woodhead, Bryant.

.2 Ground Fault Circuit Interrupter Receptacles: same as general purpose receptacles, except for the following features:

.1 Solid-state ground fault sensing and signaling.

.2 5 milliamperes ground fault trip level.

.3 Feed through type.

.3 Special Purpose Receptacles

.1 Twist lock or straight blade as noted.

.2 Voltage and amperage rating as noted.

.3 Corrosion resistant.

.4 Number of poles as noted.

.5 Nylon face.

.6 Manufacture: As for other devices.

.7 Specification grade.

2.3 Device Covers and Cover Plates

.1 Except as specifically noted otherwise, use cast aluminum covers with reinforcing ribs, resilient rubber or closed cell foam urethane gasket, four mounting screws. Use for interior switches and receptacles.

.2 Where receptacles are installed in exterior areas, the device box must be provided with a weatherproof cover that is compliant with the 'while-in-use' requirements of Section 26 of the CEC (rule 26-702). The cover shall be constructed of cast aluminum, c/w provision for padlock, and of the type that covers the receptacle when the cord is plugged in. Use Legrand P&S WIUCAST1 series or equivalent by Hubbell, T&B.

.3 Where receptacles are installed in interior areas, either on any floor/level below grade, or mounted less than 600mm above finished floor, the device box must be provided with a heavy-duty cast aluminum cover c/w single hinged spring-loaded lid and heavy rubber gasket. Use Legrand 4512 series or equivalent by Hubbell, T&B.

.4 All covers and cover plates shall be capable of accommodating GFCI type receptacles where required.

Part 3 EXECUTION

3.1 Installation, General

.1 Install wiring devices as indicated and in accordance with manufacturers written instructions.

.2 Install wiring devices only in electrical boxes which are clean.

.3 Install devices and cover plates flush and level.

.4 See drawings for specific receptacle configuration type.

3.2 Cover Plate Installation Schedule

.1 Use steel plates for outlet boxes and junction boxes at ceiling level (in non-classified areas.)

.2 Use aluminum alloy gasketed device covers for receptacles and switches in process areas.

.3 Use weatherproof aluminum plates for exterior wiring devices. Use covers with hinged lids.

.4 Use stainless steel (Type 301) for general-purpose flush mounted receptacles and switches in finished non-process dry areas.

.5 Use cast aluminum device covers specifically made for use with cast boxes in dry interior areas.

3.3 Colour Schedule

.1 Receptacles: Ivory colour, except as noted.

.2 Switches: Ivory colour, except as noted.

.3 Special Purpose Receptacle: Black, except as noted.

3.4 Replacements

.1 Replace all wiring devices and cover plates damaged during construction.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Electrical General Requirements:	Section 26-00-10
.2	Cabinets and Enclosures	Section 26-27-16

1.3 Source Of Supply

.1 All new disconnects shall be by a single manufacturer.

1.4 Coordination

.1 Coordinate installation of disconnects for equipment specified in other divisions with installation of such equipment.

.2 Install disconnect switches to locations shown.

Part 2 PRODUCTS

2.1 Disconnect Switches

.1 Unfused Disconnect Switch:

- .1 Poles, Voltage, Amperage, kW Rating and Enclosure: as indicated on drawings or schedules; if not indicated, select disconnect to suit application.
- .2 Type: heavy duty, horsepower rated.
- .3 Operation: lever handle, capable of being locked in “On” or “Off” position.
- .4 Quick-break, quick-make mechanism.
- .5 Provide neutral and ground bars.
- .6 Heavy Industrial / Heavy Duty style Safety Switch as manufactured by Allen-Bradley, or equivalent by EATON, Square D;

.2 Fused Disconnect Switch:

- .1 Same as for unfused.
- .2 Fuses 0 - 600A, HRC Class J or as specifically specified elsewhere.
- .3 Provide neutral bar and ground bar.
- .4 All fuses to be HRC rejection type.

.3 Motor Circuit Interrupters:

- .1 Circuit interrupters, 3-pole, 600 volt, rated for 20 Amp minimum, compact design, HP rated, Hubbell No. 7810 - UD, or equivalent as manufactured by Allen-Bradley, EATON, or Square D. Use for miscellaneous local motor disconnect only where specifically noted on the drawings.
- .2 Switch to be lockable in “Off” position.

Part 3 EXECUTION

3.1 Installation

.1 Install as shown on drawings.

.2 All disconnect switches to be provided in enclosures constructed and rated as outlined in Section 26-27-16 (Cabinets and Enclosures).

.3 Provide three (3) spare fuses for each fused disconnect switch.

.4 See other sections for wiring in classified area.

.5 Install a HP rated disconnect switch for each motor as specifically noted.

.6 Install a local HP rated disconnect switch for all HVAC equipment, including that which may not appear on the drawings.

.7 Disconnect switches are not permitted to be installed below grade (i.e., in wet well or dry well) and shall be installed above grade only, preferably indoors where practicable.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Electrical General Requirements	Section 26-00-10
.2	Electrical Starting and Testing – General Requirements	Section 26-08-10
.3	Control, Instrumentation, SCADA, Communication Network	Section 26-09-00
.4	Motor Control Centres	Section 26-24-19
.5	Electrical Cabinets and Enclosures:	Section 26-27-16

1.3 Reference Standards

.1 Provide motor protection switches of the EEMAC size noted. Maximum rating of units not using EEMAC rating to be equivalent to EEMAC size indicated.

.2 IEC ratings are not acceptable.

Part 2 PRODUCTS

2.1 Full Voltage Motor Starters

.1 All three-phase combination magnetic motor starters to be across-the-line magnetic starters. Each full-voltage non-reversing or reversing (FVNR or FVR) starter shall contain within its enclosure:

.1 A control transformer for each starter of 150 VA capacity to provide 120V control complete with secondary fuses and HRC primary fuses.

.2 Bright cluster LED pilot lights for each magnetic starter, red for motor running and yellow/amber for power on and green for motor stopped. (Use coloured lens caps).

.3 Two (2) N.O. and two (2) N.C. auxiliary contacts, one (1) N.O. and one (1) N.C. trip contact.

.4 Ethernet Communication.

.5 Motor circuit protector (MCP) type circuit breaker (limiters as required) unless otherwise indicated. Combination starters shall have external operating handle with lock-off facilities. Entry door shall be fitted with switch/door interlock devices.

.6 Three phase solid state overload relay (SSOL) with programmable settings for phase loss, phase imbalance, ground, fault protection, etc. – Schneider Electric TeSys T Intelligent motor protection relay, Allen-Bradley 193/592 E300 series, or matching unit by EATON.

.1 Each SSOL to come complete with network communications options as outlined under Communications Interface in this Section.

.7 HOA control and/or as noted.

.8 Door mounted pushbutton for reset of SSOL relay.

2.2 Reduced Voltage Motor Starters (Soft Starters)

.1 All Reduced voltage soft starters (RVSS) are to be provided installed in MCCs and are to match the manufacturer of the MCC (unless specifically noted otherwise). Refer to electrical drawings for quantities and ratings as indicated for all RVSS units.

.2 Each RVSS unit shall be provided complete with the following features:

.1 Input circuit breaker.

.2 Individual contactors for isolation, and bypass/run (if necessary), as shown on drawings.

.3 Ethernet communication capability, including communication card for pump control and status monitoring.

.4 Pump control option to reduce water hammer. Complete with Hand-Off-Auto switch, pilot lights, push buttons and MCC-mounted HMI as indicated on drawings.

.5 Power factor correction capacitors (where identified on drawings).

.6 Local HMI, LCD display, overload protection, control power transformer, transient protection modules (MOVs) digital I/O and auxiliary contacts.

.7 Elapsed time meter as manufactured by Hobbs mounted on enclosure door.

2.3 Magnetic Starters

.1 Schneider/Square D Type S Class 8536, Allen-Bradley Bulletin 509/505, or equivalent as manufactured by EATON.

.2 Solid state overload relay as noted.

.3 Two - speed and/or reversing as noted.

2.4 Combination Magnetic Starter

.1 Schneider/Square D Class 8536, Allen-Bradley Bulletin 513/307/303, or equivalent as manufactured by EATON.

.2 Solid state overload relay as noted.

.3 Two – speed and/or reversing as noted.

2.5 Manual Starters

.1 Schneider/Square D Type F, Allen-Bradley Bulletin 600, or equivalent as manufactured by EATON.

.2 Surface or flush mounted as required.

.3 Sized as required.

.4 Red LED pilot light.

.5 Surface boxes to be aluminum one-piece FS type.

2.6 Contactors – Full Voltage AC Magnetic Type

.1 Lighting type:

.1 Schneider/Square D Type S (Class 8903), Allen-Bradley Bulletin 500LC, or equivalent as manufactured by EATON C30 series.

.2 All lighting contactors shall be mechanically held c/w 4-poles rated for 30 A, except where specifically noted otherwise.

.2 Standard units:

.1 Schneider/Square D Type S (Class 8502), Allen-Bradley Bulletin 300, or equivalent as manufactured by EATON Freedom CN series.

.2 Non-reversing type except where specifically noted otherwise.

.3 Provide with auxiliary and holding contacts as required and as indicated on drawings (minimum. 1-spare unused auxiliary contact).

.3 Contactor coil operating voltage to be 120VAC.

.4 NEMA rated in size and configuration as noted.

2.7 Relays

.1 Relay coil operating voltage to be 120VAC.

.2 NEMA rated in required size and configuration.

2.8 Communications Interface

.1 Generally, communication between motor starters and the PLC control system will be via the intelligent motor protection relay with required protocol either inherent to the relay or through the appropriate communication module added as required. Refer to Section 26-09-00 (Control, Instrumentation, SCADA, Communication Network) for communication requirements specific to motor starters contactors, and relays.

2.9 Enclosures

.1 See Cabinets and Enclosures: Section 26-27-16

2.10 Control Devices

.1 Heavy duty oil tight 30 mm size.

.2 LED pilot lights, HOA, ON/OFF, EMERGENCY STOP, START/STOP, OFF as shown on drawings, 30mm size.

.3 Schneider/Square D Type K series, Allen-Bradley Bulletin 800T/H, or equivalent as manufactured by EATON.

.4 Provide integral matching legend plate for all control devices.

Part 3 EXECUTION

3.1 Installation

.1 In finished areas, provide flush mounted motor protection switches complete with stainless steel cover plates.

.2 Select overload device trip setting for combination starters to suit the motors. Select heaters to suit full load current of motors.

.3 Label all control components.

.4 Install starters as noted.

.5 For pre-wired package HVAC equipment, install a horsepower rated disconnect switch.

.6 Use aluminum FS boxes for thermostats and manual motor starters.

3.2 Testing

.1 Provide all testing as outlined in Section 26-08-10 (Electrical Starting and Testing)

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Supplementary Conditions:	Section 00-73-00
.2	Operation and Maintenance Data:	Section 01-78-23
.3	Electrical General Requirements:	Section 26-00-10
.4	Identification for Electrical Systems:	Section 26-05-53
.5	Electrical Starting and Testing – General Requirements:	Section 26-08-10
.6	Electrical Equipment and Systems – Demonstration and Instruction:	Section 26-08-40
.7	Control, Instrumentation, SCADA, Communication Network:	Section 26-09-00
.8	Active Harmonic Filter:	Section 26-35-26.11

1.3 Design Criteria

.1 This section establishes the requirements for the design, fabrication, inspection, testing, delivery, and installation of variable frequency drive (VFD) controllers and ancillary equipment.

.2 All drives and ancillary components to be supplied by one common manufacturer to assure a properly coordinated system. Equipment to be CSA approved and industrial grade. Commercial grade equipment will not be accepted.

.3 Use standard engineered designs. No field modified, or custom designed system will be accepted.

.4 Design all equipment using modularized solid-state equipment to allow easy maintenance and replacement.

.5 Refer to drawings for sizes.

.6 VFD’s mount in the MCC and shall be provided complete with an input line reactor, as noted herein, to meet the requirements of upstream harmonic mitigating equipment. An Active Harmonic Filter (AHF) is provided separate from the VFD’s to provide harmonic correction at an overall system level– refer to Section 26-35-26.11 (Active Harmonic Filter).

.7 Ensure compatibility of motor and VFD. Comply with NEMA MG1 Part 31 (latest edition).

1.4 Vendor Qualifications

.1 General

.1 The acceptable drive vendor to provide a factory trained sales force for consultation to answer any application and maintenance questions. Site attendance when requested must be within 8 hours.

.2 Vendor Service

.1 The acceptable vendor to have a distributor organization which stocks standard drives, modification kits and spare parts. Spare parts must be delivered to site within 12 hours.

.2 Vendor to have factory trained service representatives. The factory representative to be trained in the maintenance and troubleshooting of the equipment as specified herein. Service response must be within 12 hours.

.3 Vendor Schools

.1 Vendor to have provisions for conducting special service training schools at the customer's facility.

.4 Vendor Service Contracts

.1 The acceptable vendor to offer maintenance service contracts covering the equipment supplied. The contracts to provide for periodic maintenance inspections of the units by the vendor's factory trained service personnel. The successful vendor to have a track record proving their ability to service drives with future continuity in the industry.

.5 Quality Assurance

.1 Factory test of components and systems at the manufacturing level.

.2 Shop Test assembled system prior to shipping to site.

.3 Field Tests: testing of installed system prior to or as part of the start-up phase.

Part 2 PRODUCTS

2.1 VFD Manufacturer

.1 Supply of VFDs shall be coordinated with the MCC manufacturer. VFDs from the following manufacturers will be accepted:

.1 Schneider/Square D (Altivar Process ATV630 series),

.2 Allen-Bradley (Powerflex 753/755 series),

.3 EATON (DG1, Power XL series),

.4 ABB (ACS 800 series)

2.2 Ambient

.1 The VFD to be suitable for use in normal indoor non-hazardous industrial environments for a temperature range of 0° - 40°C and a humidity range of 5% - 95% for enclosed units.

.2 Provide fan assisted cooling on the front of each VFD enclosure.

.1 Size and quantity of fans to be as required to ensure adequate cooling and air flow.

.2 Each fan assembly shall be provided complete with field replaceable filter media.

.3 The filter media shall be easily replaceable from the outside of the enclosure via hinged cover (or equivalent) without requiring personnel to access the interior of the cabinet.

.4 Fans to be rated for operation on 120VAC from the VFD control power circuit and suitable for operation via thermostat.

2.3 Construction

.1 Design the VFD to provide for ease of maintenance.

.2 The VFD shall consist of the following major components applicable to each VFD:

.1 Input rectifier section to supply fixed DC bus voltage.

.2 Three Phase-to-phase and three phase-to-ground MOVs for transient protection.

.3 Smoothing input reactor for each incoming phase, 3% impedance for 575 volt units as a minimum.

.4 DC bus capacitors.

.5 Sine weighted PWM generating inverter section.

.6 Suitable snubber circuitry to control output voltage spikes and to control rise times of the output pulses.

.7 Built in ground fault protection.

.8 Microprocessor to control PWM pulse generation, microprocessor specifically dedicated to PWM pulse generation.

.9 Load dv/dt filter to limit voltage to 1000V max. at all motors. Rise time not to exceed 500 volts per microsecond. Filter to be TCI type KLC dv/dt Guard, type LC by MTE Corp or Rex AFD output filter

.10 In each VFD include, as standard, a fully digital text display, which will display programming, operation, and fault code diagnostic information. This display to be mounted on the outside of the enclosure door.

.11 The VFD shall be modularly constructed. Provide printed circuit boards with plug-in connections and easily removable from the drive.

.12 The control printed circuit board to be interchangeable for all comparable HP ranges of VFD.

2.4 Assembly

.1 VFD's shall be fully assembled complete with line reactor, load dv/dt filter, starter(s), etc. all mounted onto MCC backplate for integration into MCC the by the MCC manufacturer.

2.5 VFD Size / Ratings

.1 Size each VFD for current rating of the motor load.

.2 The load to be either a constant torque or a variable torque load type as specified. Program VFD for specific load characteristic.

2.6 Electrical Design Characteristics

.1 Input Power

.1 Unless otherwise specified, the VFD to accept nominal supply voltage +10% 3-phase 60 Hz, 600V.

.2 Permit variations of 48 to 63 Hz of line frequency without the VFD shutting down on a fault.

.3 Permit power line interruptions for high inertia loads for at least 2.0 seconds without the VFD shutting down on a fault providing an extended power loss ride-through. If the drive trips on undervoltage, the drive will activate the Automatic Restart.

.4 The VFD shall present a displacement power factor of 0.98 or better to the AC line at any speed or load. Full load effective power factor shall be 94% or better.

.5 Efficiency of VFD controller shall be not less than 97% at 60-hertz output when driving the specified maximum load.

.6 The VFD shall not require an input isolation transformer.

.7 VFD assembly to have an interrupting rating of 25 kA RMS, SYM. at 600V 3 phase.

.8 The VFD to include transient voltage suppression to allow reliable operation encountered in an industrial/commercial power distribution system for transients up to 3000V, 50 JOULES.

.9 Separate control wiring from power wiring. Locate control components and relays away from power relays, etc.

.10 Locate load terminals at top of enclosure and wire directly into main breaker from the MCC bus.

.11 Arrange components and wiring to minimize interference in control circuitry.

2.7 Output Power

.1 The VFD to produce a three-phase output for the load.

.2 The VFD to be of the Pulse-Width Modulated type and to consist of a full wave diode bridge converter to convert incoming fixed voltage/frequency to a fixed DC voltage. The Pulse Width Modulation strategy shall incorporate a microprocessor to handle all Logic functions as well as the complex, sine-coded PWM generating algorithms that control output stage switching. Generate the inverter output by IGBT power transistors only.

.3 Unless otherwise specified, the standard VFD output frequency to be programmable from 0 to 66 Hz.

.4 When subject to the range of ambient conditions stated the VFD to be capable of delivering 115% of rated output current for up to one minute for variable torque loads. (For constant torque application a minimum of 135% of rated output current).

.5 The VFD output waveform to be the PWM type waveform producing smooth torque at low frequencies and low current harmonics.

.6 The VFD to be capable of operating output open circuited with no fault or damage for startup and testing purposes.

.7 Electrical noise and radio interference to be limited to levels specified in applicable standards. Equipment to be so designed that use of radio communication equipment adjacent to VFD units is permissible. In addition, the variable speed equipment not to be susceptible to interference from radio equipment operated adjacent to it.

.8 Provision of adequate grounding within the equipment in addition to protection means for electrostatic discharge.

2.8 Protective Features

.1 Incorporate the following protective features with each VFD:

.1 Main circuit breaker minimum interrupting rating of 25 kA RMS sym.

.2 Fully protect the VFD against load faults. Bolted faults, phase to phase or phase to ground, shall not damage the unit. Design VFD to withstand the short circuit currents. Provide line side HRC fuses. Provide one set of three spare fuses.

.3 Adjustable current limit from 50 - 135 percent (50 - 115 percent for variable torque loads) rated current of unit. The VFD to avoid nuisance current trips caused by short acceleration or deceleration settings by temporarily increasing the acceleration or deceleration times.

.4 Provide the following additional protection features:

.1 Phase protection.

.2 3 phase overvoltage.

.3 Undervoltage sensing.

.4 Heat sink temperature monitoring.

.5 Ground fault detection.

2.9 Control Features

.1 Provide two (2) isolated analog inputs that are both capable of operating from 0 - 20 mA.

.2 Provide two (2) isolated analog outputs, which can be programmed to be proportional to any two of the following:

.1 Output frequency

.2 Motor speed

.3 Motor torque

.4 Motor power

.5 Output current

.6 DC bus voltage

.7 Motor voltage

.3 All VFD set-up operations and adjustments to be digital and stored in a non-volatile memory (EEPROM). No analog or potentiometer adjustments to be allowed.

.4 VFD operation to be fully digital with microprocessor control of frequency, voltage and current.

.5 Output signals available to be monitored by PLC control system as follows:

.1 analog (4-20 mA or 0-10 VDC) signal corresponding to speed

.2 digital output (isolated contacts) for VFD fault indication

.3 digital output (isolated contacts) for VFD run status

.4 digital output (isolated contacts) for VFD “HAND” selected

.5 digital output (isolated contacts) for VFD “AUTO” selected

2.10 Digital Operator Station (Front Panel)

.1 Provide an operator station on the drive door complete with the following features as a minimum:

.1 Human Interface Module (HIM)

.2 START pushbutton for local control (within HIM keypad).

.3 STOP pushbutton for local control (within HIM keypad).

.4 HOA selector switch.

.1 In “HAND” mode; the VFD is operated by the keypad.

.2 In “AUTO” mode; the VFD is operated by the PLC system.

.5 Speed raise/lower pushbuttons with digital frequency display for local speed adjustment.

.2 The digital operator station with text display to be capable of being mounted on the drive and/or on the drive panel (i.e., MCC cubicle door) face.

.3 Provide pilot lights to indicate switch position and VFD operating modes.

2.11 Speed Control

.1 The VFD to contain an independent parameter, which provides an adjustable minimum speed setting from 0 to 60 Hz.

.2 The VFD to contain an independent parameter, which provides an adjustable maximum speed setting from 40 to 90 Hz.

.3 The VFD to accept an isolated analog input speed reference of 4-20 mA and be adjustable via the digital operator station.

.4 The 4-20 mA analog input speed reference signal to be isolated. Calibration adjustments shall be provided within the speed ranges specified.

.5 Selectable stopping modes of coast, ramp to stop or DC brake to stop shall be available.

.6 Provide adjustable skip frequencies with programmable bandwidth.

2.12 Drive Controls

.1 Provide control transformer with primary and secondary fuses, terminal blocks and control relay(s) interconnected in accordance with the project requirements.

.2 The VFD to accept an isolated output signal via PLC to stop and start the drive.

.3 The VFD inverter to have capability to interlock up to 3-N/C external interlocks.

.4 The VFD to provide 3 programmable Form C dry contact outputs. Status of contacts to indicate:

.1 Run

.2 Ready

.3 Fault

.5 The VFD to be wired to achieve the following functionality:

.1 Motor selected to "AUTO" enables motor to be started, stopped and speed to be adjusted via PLC.

.2 Motor selected to "HAND" enable motor to be started, stopped and speed to be adjusted via the front panel keypad.

2.13 Drive Protection/Fault Annunciation

.1 The VFD to be capable of monitoring the following conditions or sensing the following faults. Where indicated in the following text, the condition or fault shall be annunciated on the diagnostic display panel. The panel to be mounted on the front of the VFD and visible through the door of the enclosure. The VFD to instantaneously shut down when a fault condition occurs.

.1 Short circuit protection.

.2 DC bus undervoltage protection.

.3 DC bus overvoltage protection.

.4 Over temperature protection.

.5 Power semiconductor protection.

.6 Ground Fault protection.

2.14 Communications Interface

.1 Refer to and comply with the Section 26-09-00 (Control, Instrumentation, SCADA, Communication Network) for communication requirements specific to VFDs.

.1 Provide VFD with either inherent communication capability or appropriate communication module(s) as necessary to meet the network connectivity requirements listed within Section 26-09-00.

.2 Provide software for personal computer use to upload and download parameters.

2.15 Diagnostic Features and Fault Handling

.1 Provide a microprocessor based digital diagnostic system, which monitors its own control functions and displays faults and operating conditions. Microprocessor systems must be product of the same manufacturer as the VFD to assure single source responsibility, availability of service and access to spare parts.

.2 The digital keypad allows the operator to enter exact numerical settings. A plain English user menu shall be provided in software as a guide to parameter setting, (rather than codes). Drive parameters shall be factory set in EEPROM and be re-settable in the field through the keypad. Multi levels of password security shall be available to protect drive parameters from unauthorized personnel. The EEPROM stored drive variables must be able to be transferred to new boards to reprogram spare boards.

.3 The VFD to execute, on initial power-up, a self-diagnostic check. The integral programming display panel shall provide first fault indication of VFD protection functions. Fault indication to be retained if input power is lost. The following faults to be displayed on the local programming panel:

.1 Overcurrent.

.2 Short Circuit/Ground Fault.

.3 Under voltage.

.4 Over voltage.

.5 Over temperature.

.6 Power Supply Fault.

.7 Motor stalled.

.4 Fault codes to provide direction as to board level and input-output level to aid in troubleshooting.

.5 The fault log record shall be accessible via a RJ45 Ethernet/IP link as well as line-by-line on the keypad display.

.6 Self-diagnostic check to indicate faulty internal components.

.7 Provide a trace buffer to store actual values of up to eight different programmable signals at the time of a fault trip. The information to be stored in memory to be retrieved by PC or a recorder.

2.16 Factory Testing

.1 Provide certification that the following tests have been successfully completed.

.2 Factory tests include but are not limited to:

.1 Testing of power transistors, diodes, and other solid-state components to ensure correct function and highest reliability.

.2 All control printed circuit boards shall be dynamically tested while heat cycled.

.3 Power semiconductors must be fully tested for proper electrical characteristics (dv/dt, di/dt, etc.)

.4 Functional testing of chips (CMOS, TTL, LINEAR, etc.).

.5 Functional testing of power capacitors and active components.

.6 Inspection of sub-assemblies and/or testing for conformance to manufacturer's engineering and quality assurance specifications.

.7 All power components are to be run under "worst case" conditions for at least 20 minutes.

.8 The VFD to be functionally tested with a motor for 20 minutes before shipment to assure proper operation per specification to applicable CSA and IEEE standards.

.9 Factory tests to be done by manufacturer to ensure proper system operation, freedom from grounds and open and short circuits.

.10 Conduct visual equipment inspection and functional test of assembled VFD units.

2.17 Field Test

.1 Do start-up test for each VFD. Confirm correct operation of all programmed and diagnostic functions.

.2 Do visual inspection, test, and check all connections and confirm correct installation.

.3 Calibrate all settings as required.

.4 Provide a written report of the start-up and test for each VFD and include parameter settings.

.5 Coordinate with automation trade and user group.

.6 Refer to Section 26-08-10 – Electrical Starting and Testing.

2.18 Documentation

.1 Provide operating and maintenance manuals.

.2 Provide as tested, as built, final power and connection drawings.

.3 Provide as left parameter settings for all functions.

.4 Refer to Section 01-78-23 – Operation and Maintenance Data.

2.19 Training

.1 Provide operator training, maintenance, and servicing seminar.

.2 The on-the-job training to cover the following topics as a minimum:

.1 Theory.

.2 Configuration/models.

.3 Setup.

.4 Maintenance.

.5 Troubleshooting.

.6 Refer to Section 26-08-40 – Electrical Equipment and Systems Demonstration and Instruction.

2.20 Labels

.1 Install screw-on lamacoid nameplates to all face mounted components and all interior components.

Part 3 EXECUTION

3.1 Installation

.1 Install to locations noted.

.2 Complete all testing as specified.

.3 Coordinate with MCC vendor.

.4 Ensure that the amperage capacity of the VFD is suitably matched or exceeds the amperage of the motor.

3.2 Warranty

.1 Provide a 2-year basic warranty.

.2 Refer to and comply with Section 00 73 00 (Supplementary Conditions).

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Supplementary Conditions	Section 00-73-00
.2	Electrical General Requirements	Section 26-00-10
.3	Electrical Starting and Testing – General Requirements	Section 26-08-10
.4	Control, Instrumentation, SCADA, Communication Network	Section 26-09-00
.5	Automatic Transfer Switch	Section 26-32-91

1.3 Related Work Specified in Other Divisions

.1 Fuel supply, storage tank(s) (when applicable), ventilation for unit, exhaust piping and muffler installation from manifold outwards by others.

1.4 System

.1 Provide emergency power system for supply of power in the event of failure of normal supply as indicated and in accordance with Canadian Electrical Code and local inspection authority.

.2 System to consist of complete standby power supply unit liquid cooled radiator and fan, diesel engine directly coupled to AC alternator complete with fittings, connections, auxiliaries, control panels, safety devices, meters, etc. as indicated for a complete operating system.

.3 Provide fully automatic operation such that upon power failure, unit is online taking full required load within 10 seconds. On resumption of normal power after time delay on transfer switch, load shall re transfer to normal power and after rundown time delay, generator unit shall automatically shut down and return to starting condition ready for another operating cycle.

.4 The generator is to be provided in a weatherproof enclosure and the complete unit shall be constructed to be CSA C282 (latest edition) compliant.

1.5 Supplier Qualifications

.1 The equipment shall be supplied and installed by a firm normally engaged and fully competent in this type of work. The firm shall have been continuously engaged in this business for at least ten years. It shall show upon request that it maintains a fully equipped and qualified service organization capable of performing the present work as well as providing adequate and continuous service to the system after installation.

.2 Service and parts facilities in close proximity with 24-hour service, experienced in installation and operation of set of comparable size. Service response must be within twelve (12) hours during normal daytime working hours.

1.6 Reference Standards

.1 Generator(s) supplied under this section shall comply with the requirements of the following standards:

.1 CSA C282 – Emergency Electrical Power Supply for Buildings

Part 2 PRODUCTS

2.1 General Construction

.1 Weatherproof enclosure containing genset, muffler, air louvers, battery, controller, breakers, etc. to make a complete genset assembly. Enclosure is to be rated as 'Level 2' type with a maximum sound rating of 75 decibels at a distance of 7 meters from the enclosure.

.2 The generator enclosure shall be complete with exhaust dampers and a motorized air intake. Dampers shall be closed when the unit is not running. Provide multiple lockable access doors. The generator enclosure shall have a light switch and two (2) interior 120 VAC LED lights.

.3 Sub-base double walled, fuel tank sized for 24-hour operation at full load c/w level sensors and two fill ports.

.4 Constructed with suitable means for lifting.

.5 Enclosure paint finish to be Vendor's standard color.

.6 Mount the engine and generator in a weatherproof sound attenuated enclosure.

.7 Provide semi-flexible coupling between generator and engine and protective guards over moving parts.

.8 Provide fuel shut-off valve and water shutoff solenoid.

.9 Provide all conduit, wiring, and connections required, as recommended by unit supplier.

.10 Coordinate to ensure proper execution of work covering ventilation, cooling and fuel supply and products of combustion exhaust, to form an efficient and well-coordinated layout.

2.2 Generator

.1 The generator shall be single bearing type with drip proof enclosure with permanent magnet exciter and static voltage regulator capable of providing stable voltage and frequency within 1% of the rated values within 15 seconds of the loss of normal power.

.2 The generator shall be standby rated for 125 kW, 156 kVA, 600 V, at 125°C temperature rise, 60 hertz, 3 phase, 4 wire, 1800 RPM. The unit shall be capable of carrying these loads for the interval between interruption and restoration of the normal power source.

.3 The generator shall be directly connected to the engine through semi flexible coupling and shall be self-ventilated with self-lubricating bearing.

.4 Voltage regulator shall be solid-state temperature compensated, with three phase average sensing, automatic voltage control, rheostat, and stability adjustment. Voltage regulation shall be within ±10% at any load.

.5 Provide solderless terminals suitable for connecting feeder cables, also bring the neutral out for grounding. Provide an adequately sized terminal cabinet.

.6 Wave form deviation shall be less than 5% line to line total harmonic distortion.

.7 Radio frequency interference filtering.

2.3 Engine

.1 The engine shall be diesel fueled, exhaust gas turbo charged, and water cooled by heat exchangers. The engine standby output capacity shall be sufficient to deliver rated generator kW at 1800 RPM at 30°C ambient temperature at this location.

.2 Operating speed of the engine shall not exceed 1800 RPM.

.3 Emissions standards – the engine shall be at a minimum certified to EPA Tier 3, for emergency standby power usage.

.4 The engine governor shall be an electronic type providing speed control from no load to full load within 0.5% of rated speed. The engine shall be complete with overspeed shutdown in the event of a governor failure.

.5 The engine shall be complete with:

.1 Cam-operated unit fuel injection system with replaceable element type primary and secondary fuel filters.

.2 Self-lubricated, positive displacement, gear driven lube oil pump with pressure relief valve.

.3 Full flow oil filter with replaceable elements and lube oil cooler providing full pressure lubrication to all bearing surfaces.

.4 Self-lubricated, gear-driven centrifugal water pump with seal leakage indicator.

.5 Battery charging alternator.

.6 Hand operated rotary pump to pump lube oil out of the engine when an oil change is required.

.7 All hot and rotating parts to be guarded.

.8 Provide unit mounted fan driven radiator.

.6 For fuel inspection purposes, provide braided fuel lines and union connections between fuel tank and engine.

.7 The engine shall be complete with a 24 VDC control system.

.8 Provide a minimum 4000W, 208V single phase jacket water heater with thermostatic control to maintain engine temperature at a sufficient level to maintain normal engine starting temperatures.

.9 The engine supplier shall provide the contractor with complete details regarding external connections to the unit including exhaust pipe size, air requirements, fuel, and cooling water piping requirements.

.10 Provide a terminal box on the engine to terminate all engine wiring.

.11 Provide lubrication oil and coolant as required. Provide drip tray. Provide glycol tank with sight glass.

.12 Dry type replaceable air cleaner elements.

.13 Stop / Start Sequence: in automatic position, auxiliary contacts in transfer switch initiates starting cycle of unit. Cranking limiter relay to limit cycle to 45 seconds after which if engine fails to start, trouble circuit contacts close illuminating appropriate trouble Annunciator window and locking out starting cycle until manually reset. On starting of engine, starting circuits automatically reset. On resumption of normal power after time delay in transfer switch, load to retransfer to normal supply and following rundown period engine shall shutdown and return to starting condition.

.14 Provide an electric battery blanket heater.

.15 The weatherproof enclosure shall be furnished with thermostat-controlled space heater(s) so as to maintain the interior of the enclosure at a temperature of no less than +10°C.

.16 Provide primary output circuit breaker (for connection to ATS):

.1 Molded case type in enclosure mounted to generator skid, with integral electronic LSI trip unit, adjustable trip setting, and lockable in the 'OFF' position. Breaker to be complete with auxiliary open-close contacts. Refer to single line diagram (SLD) drawing for breaker frame and trip ratings.

.17 Provide secondary output circuit breaker (for connection to portable load bank):

.1 Molded case type in enclosure mounted to generator skid, with thermal magnetic trip unit, adjustable trip setting, and lockable in the 'OFF' position. Refer to single line diagram (SLD) drawing for breaker frame and trip ratings.

.18 Provide a panelboard (120/208 VAC, 3-phase, 4-wire) in the weatherproof enclosure to feed noted loads at the generator. Size panel to house four (4) single-pole spaces.

.19 Interior mounted emergency battery lighting unit with 120 VAC charger. Two (2) 6 W adjustable LED lighting heads and battery sized for a minimum of 2 hours operation. Sheet steel cabinet, long life lead acid batteries, 120 VAC plug-in cord.

2.4 Muffler

.1 Hospital plus grade, silenced type, heavy duty, fully sealed metal, prime finish.

.2 Flange fittings drain connection.

.3 Expected sound attenuation of 35 decibels to 50 decibels over a frequency bandwidth of 60 Hz to 8 kHz.

.4 Install on spring type compensating hanger.

.5 Install drain valve on muffler and drain line.

.6 Ensure muffler is properly insulated from surrounded combustible material and that adequate space is given to accommodate the muffler temperatures, otherwise insulate the muffler.

.7 Custom made adapting sections to manifold to suit on-site conditions.

.8 Provide flexible connection from manifold to muffler. Use heavy-duty carbon steel smoke tight unit with flanged couplings. Exhaust outlet to be flanged.

2.5 Battery And Charger

.1 Battery Bank: 24 VDC lead acid of sufficient capacity to provide a total of 60 seconds of cranking time at 10°C consisting of six 10 second cranking attempts with the battery voltage not dropping below 20 VDC.

.2 Battery Charger: solid-state constant potential type with manual and automatic control mounted on wall adjacent to unit complete with DC ammeter, voltmeter, overload protection, ac input switch, pilot switch for AC "On", equalizing charge and high rate charge. Must be able to recharge a fully discharged battery to 80% full charge within four hours and to 100% full charge with twelve hours.

.3 Regulation: ±1% for ±10% input variation.

.4 Charger will provide visual output along with individual form "C" contacts for indication of:

.1 Loss of AC power: Red lamp

.2 Low battery voltage: Red lamp

.3 High battery voltage: Red lamp

.4 Power on: Green lamp (no contact)

.5 Battery Units: housed in separate ventilated metal enclosure with a wooden removable top and mounted on floor adjacent generator set.

2.6 Engine Alarms

.1 Engine mounted instruments and alarm contacts for:

.1 Low oil pressure.

.2 Low coolant level

.3 High coolant temperature.

.4 Overspeed.

.5 Low coolant temperature.

.6 Over cranking

2.7 Control Panel (Unit Mounted)

.1 System

.1 Contains 600 V molded case generator output breaker(s) - size noted on drawings.

.2 Contains engine control equipment.

.3 Contains generator output instrumentation.

.4 Standard digital power meter as provided by unit manufacturer.

.5 Contains generator output instrumentation.

.6 Fully programmable microprocessor controller.

.7 NFPA 110 compliant.

.8 Provision for hardwiring to SCADA system for selected alarms.

.9 In addition to hard wiring, ethernet connection to a remote PLC.

.10 Voltage regulation of ±5%.

.2 Controls

.1 Engine start button.

.2 Engine emergency stop button plus provision for remote emergency stop button.

.3 Voltage control rheostat to be mounted on the inside of the control panel and to be screwdriver adjust type with locking nut.

.4 Selector switch labelled Auto-Manual-Off-Start-Test.

.3 Shutdown Alarms and Indicators

.1 Provide a digital display or pilot lights listed below.

.2 Set of safety shutdown and alarm circuits with indicating lights and dry contacts for remote annunciation for each alarm. Indicating light colors shall be Red for shutdown, Amber for alarm, and White for status. Provide the following as a minimum:

Function	***Color***	***Function***	***Color***
Unit not in auto	Amber	Low water temp. alarm	Amber
Engine low oil pressure	Red	Low oil pressure pre-alarm	Amber
Engine high water temp.	Red	High water temp. pre-alarm	Amber

Engine overspeed	Red	Low fuel pressure	Amber
Engine over crank	Red	Engine in cool down	White
Engine running	White	Alternator under voltage	Amber
600 V Gen. CB open/trip	Amber	Under frequency	
Emergency stop	Red	Alternator over voltage	
Battery charger failure	Amber	8 spare positions	
Low battery voltage	Amber		

.3 Lamp test push-button.

.4 Alarm test push-button.

.5 Unit NC/NO run contact

.6 Run Time meter

.7 Common alarm NC/NO alarm contact.

.8 Controller to provide the standard programmable 24 alarm outputs along with ethernet compatible communication.

.4 Cool Down Relay

.1 Cool down relay, solid-state adjustable 1 – 30 min.

.5 Start Time Delays

.1 Start Time delays, solid-state, adjustable 0 – 25s – 180s.

.6 Manual Exerciser Switch

.1 With a 0 – 4 hr. solid-state timer and connected to switch to emergency load for testing of unit.

.7 Retransfer Time Delay

.1 Solid-state adjustable 20 s – 600 s for emergency to normal.

.8 Miscellaneous

.1 Include one (1) 120 VAC duplex receptacle, mounted on the interior of the enclosure, connected to a dedicated 15 A circuit.

2.8 Generator Set Manufacture

.1 As manufactured by MTU Onsite Energy, Cummins, Kohler, or Caterpillar.

Part 3 EXECUTION

3.1 Installation

.1 Install complete unit including all accessories in accordance with the manufacturer's recommendations.

.2 Install and connect all associated power and control wiring 24VDC power supplies, etc.

.3 The unit supplier shall provide the services of qualified technical representative to supervise and check out the complete installation.

.4 The unit supplier representative shall perform the testing in the presence of the Owner Representative. The system shall not be started until the Owner's Representative is present.

.5 Install permanent rust inhibitor type antifreeze in the cooling system to protect to minus 40°C.

.6 Make all connections to equipment with flexible connectors to minimize effects of vibration.

.7 Provide all fuel for onsite tests (when applicable) and after acceptance of all on-site tests.

.8 Field control wiring shall utilize stranded conductors.

3.2 Tests

.1 The new motor generator set unit shall be completely factory and on-site tested and the results certified, proving the performance of the set to provide capacities as listed in these specifications.

.2 The supplier shall be responsible for two separate test programs:

.1 Final production testing

.2 On-site test

3.3 Final Production Testing

.1 The engine-generator set shall be completely factory tested, with guards and exhaust system in place, and the results certified, proving the performance of the set to provide the capacities listed in this specification.

.2 The shop tests shall include but not be limited to the following:

.1 Protective alarm and shutdown verification.

.2 Operate the generator set at no-load, ¼, ½, ¾, and full load for a total of one hour at unity power factor. Record amperes, voltage, and frequency throughout the test.

.3 Confirm the generator set is capable of picking up full load in one step without exceeding 20% instantaneous voltage dip.

.4 Verify complete control system alarm functions.

.3 The entire system shall be tested and approved in the presence of the Owner's Representative at the manufacturer's facility, prior to shipment to the work site.

3.4 On-Site Testing

.1 Carry out start-up and commissioning tests at the site on the engine generator unit before acceptance of same. Provide a qualified service technician for the time required for start-up, testing and adjusting of the unit to the satisfaction of the Owner's Representative. Allow for a minimum of 2-days for all setup, startup, commissioning, testing and training activities. Coordinate with the installation contractor to confirm correct operation of the automatic transfer switch

.2 The on-site tests shall occur only after the unit has been verified in writing by the manufacturer or his representative as being installed and mounted correctly, stating that the ambient and all utilities (fuel, cooling air and combustion) are of the proper size and quantities required for the unit to perform correctly and they are 100% complete and functioning correctly.

.3 The supplier shall supply all load banks and accessories (cables, meters, etc.) required to test the unit on-site prior to approval and acceptance by the Owner's Representative.

.4 The test shall include, but not be limited to:

.1 Simulate power failure including operation of:

.1 Transfer switch.

.2 Automatic starting cycle.

.3 Automatic shutdown and return to normal.

.4 Manual operation.

.5 Load pickup on exercise mode.

.2 Perform four-hour load test utilizing portable test bank. Apply load in 20% steps every 30 minutes until full load is applied. Record the following at 15-minute intervals during entire tests:

.1 Kilowatts

.2 Amperes

.3 Voltage

.4 Frequency

.5 Oil pressure

.6 Coolant temperature

.7 Enclosure temperature

.8 Power factor.

.3 After a cool down period, as specified by the manufacturer, simulate a power failure, the unit will pick up to the actual building emergency loads. Operate these loads for one hour or a length of time indicated by the Owner's Representative after which it shall be re-transferred back to normal power. During this test record data noted above. Confirm all time delay settings.

.5 Vendor shall use his own test forms and after completion shall send a copy of the test report to Owner's Representative.

.6 Complete all testing of the generator in coordination with testing of the overall emergency power system as outlined in Section 26-08-10 (Electrical Starting and Testing)

.7 Complete generator testing as specified herein and at a minimum, comply with CSA C282 code.

3.5 Warranty

.1 Provide a 2-year basic warranty.

.2 Refer to and comply with Section 00 73 00 (Supplementary Conditions).

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Supplemental Conditions	Section 00-73-00
.2	Electrical General Requirements:	Section 26-00-10
.3	Motor Control Centers:	Section 26-24-19
.4	Electrical Starting and Testing – General Requirements:	Section 26-08-10
.5	Control, Instrumentation, SCADA, Communication Network:	Section 26-09-00

1.3 Design Criteria

.1 Automatic load transfer equipment to:

- .1 Monitor voltage of normal power supply.
- .2 Initiate cranking of standby generator unit on normal power failure.
- .3 Transfer load from normal supply to standby unit when standby unit reaches rated speed and voltage.
- .4 Transfer load from standby unit to normal power supply when normal power restored.
- .5 Shutdown standby unit.
- .6 Send signals to SCADA Cabinet as required by drawings utilizing ethernet communications and ethernet communications module.

1.4 Reference Standards

.1 Automatic transfer switch(es) supplied under this section shall comply with the requirements of the following standards:

- .1 UL 1008 / CSA C22.2 No. 178.1 / NMX-J-672-ANCE – Transfer Switch Equipment (Tri-national Standard)
- .2 CSA C282 – Emergency Electrical Power Supply for Buildings

Part 2 PRODUCTS

2.1 Transfer Mechanism

.1 Three phase contacts designed for double throw action, motor/solenoid operated, mechanically held, and interlocked, mounted in MCC (where possible). Pressure type contact switch mechanism specifically designed for transfer switch use. Switches utilizing molded case breakers for load contacts are not acceptable.

.2 Rated 347/600V, 3 phase, 4 wire. Amperage rating noted on drawings.

.3 Withstand rating: 42 kA, RMS, SYM.

.4 Dead front construction with access to relays and control for inspection and maintenance, and manual operating lever for transfer switch.

.5 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.

.6 Means to operate manually.

2.2 Controls

.1 Selector switch - four position “Test” “Auto” “Manual” Engine Start”.

.1 Test position - Normal power failure simulated. Engine starts, and transfer takes place. Return switch to “Auto” to stop engine.

.2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.3 Manual position - Transfer switch may be operated by manual handle, but transfer switch will not operate automatically, and engine will not start.

.4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to “Auto” to stop engine.

.2 Control transformers: with 120V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum, sealed type, solid state type.

.1 Voltage sensing, one per phase, solid state type adjustable drop out and pick up, close differential, 2V minimum undervoltage overvoltage protection.

.2 Time delay, normal power to standby, 5s to 180s on delay on engine start.

.3 Time delay on retransfer from standby to normal power, adjustable 20s to 600s.

2.3 Communications Interface

.1 Refer to Section 26-09-00 for communication requirements specific to the automatic transfer switch.

2.4 Accessories

.1 Pilot lights (L.E.D. type) to indicate switch position, green for normal, red for standby, mounted in panel. Pilot lights indicating normal power on and emergency power on.

.2 Auxiliary relay to provide 2 N.O. and 2 N.C. contacts on both normal and emergency positions.

.3 Solid state electronic monitors:

.1 Undervoltage type, three-phase with time delay.

.2 Adjustable under frequency type for nominal frequency of 60 Hz.

2.5 Manufacturer

.1 ASCO 7000 Series (7ATS) transfer switch with in-phase monitor, or approved equivalent.

Part 3 EXECUTION

3.1 Installation

.1 Locate, install, and connect transfer switch as indicated on drawings.

.2 Check relays solid state monitors and adjust as required.

.3 Coordinate with the MCC supplier

3.2 Service

.1 Supplier to have local service capability and must be able to provide service within 12 hours during normal daytime working hours.

3.3 Testing

.1 Testing of the ATS shall include, but not be limited to:

- .1 Visual inspection.
- .2 Mechanical parts inspection.
- .3 Contact resistance test
- .4 Verification of all settings and operations
- .5 Verification of engine start sequence, engine cool-down, and engine shut-down features
- .6 Function check of time-delay and re-transfer features
- .7 Confirmation of phasing, phase rotation and synchronization function.
- .8 Verification of interlocks

.2 Perform a system function test by simulation of the following:

- .1 Loss of normal power
- .2 Return to normal power
- .3 Loss of emergency power
- .4 All forms of single-phase conditions.

.3 Complete all testing of the ATS in coordination with testing of the overall emergency power system as outlined in Section 26-08-10 (Electrical Starting and Testing).

3.4 Warranty

.1 Provide a 2-year basic warranty.

.2 Refer to and comply with Section 00 73 00 (Supplemental Conditions)

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 Related Work Specified in Other Sections

.1	Electrical General Requirements:	Section 26-00-10
.2	Electrical Starting and Testing – General Requirements:	Section 26-08-10
.3	Electrical Equipment and Systems – Demonstration and Instruction:	Section 26-08-40
.4	Control, Instrumentation, SCADA, Communication Network:	Section 26-09-00
.5	Dry Type Transformers up to 600V Primary	Section 26-12-17
.6	Variable Speed Drives:	Section 26-29-23

1.3 System Description

.1 Performance Requirements

- .1 Performance as defined assumes a properly sized AHF and impedance installed on nonlinear loads. Impedance shall be 3% or larger on every nonlinear load.
  - .1 THD(v) shall be limited to not more than 5 percent as contributed by the loads at the location of each AHF.
  - .2 THD(i) shall be limited to 3% or less as long as AHF is 50% or more loaded.
  - .3 Displacement power factor (PF) shall be corrected to 0.95 or better at the location of each AHF.
- .2 Displacement PF shall never go leading due to AHF performance or design.
  - .1 Source current imbalance shall not exceed 2% phase-to-phase after correction.

.2 Service Conditions

- .1 Operating Ambient Temperature Range: 0 – 40 degrees Celsius
- .2 Humidity: 0 – 95%

1.4 Manufacturer Qualifications

.1 Manufacturer shall be a firm engaged in the manufacture of low voltage active harmonic filters of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 10 years.

Part 2 PRODUCTS

2.1 Equipment Size/Ratings

.1 Active harmonic filter (AHF) shall be designed to operate from an input voltage of 480 VAC to 600 VAC or 600 VAC to 690 VAC, plus 10 percent, minus 15 percent at each nominal voltage.

.2 Where an autotransformer is required for the AHF to be compatible with the rated voltage of the electrical distribution system, the AHF shall be provided with either an integral autotransformer or autotransformer in separate enclosure. Refer to drawings for general arrangement.

.1 Where an autotransformer is required separate from the AHF, provide the autotransformer in accordance with Section 26 12 17 – Dry Type Transformers up to 600V Primary.

.3 AHF shall be designed to operate with an AC supply frequency of 60 Hz, +/- 3 Hz.

.4 AHF heat losses shall not exceed more than 5 percent of the unit kVAR rating.

.5 Ampere rating as specified in the drawings.

.6 Up to 10 units of any size combination shall be able to be paralleled to inject current according to the information received from one set of supply current transformers (CTs) located at the source of supply for loads and all active harmonic filter.

.7 When parallel units are employed if one or more units is offline, the remaining units shall adjust their total output to attempt to make up for the unit(s) offline.

.8 All units operating in parallel shall have a common digital series communications connection between all of them.

.9 Each unit that receives the primary CT is considered a master unit. If any master is offline, another master shall control the system.

.10 Units not receiving primary CT are considered slaves.

.11 AHF that turns off all units when one is taken offline in the parallel arrangement is not acceptable.

.12 All floor standing units shall provide incoming bus bar terminations for both top and bottom entry. At least two cables per phase may be landed.

.13 AHF floor standing units shall include a door-interlocked circuit breaker rated at 100 kAIC (UL Rated) and 20 kAIC (IEC rated) for 600 VAC and below.

.14 An energy saving feature shall be provided to permit stopping AHF when load goes below a desired set point (10% factory setting) and turn on at some higher set point (15% factory setting).

.15 A service port is provided in the front cover of each unit chassis such that with power disconnected a USB connection from a laptop computer may examine past performance and review all parameter set points and the event log. This may be used for commissioning or service.

2.2 Active Harmonic Filter Unit

.1 Enclosure

.1 Provisions shall be made for locking disconnects in the off position.

.2 AHF shall be mounted in NEMA Type 12 enclosures (or IEC rated IP equivalent). Enclosures shall be freestanding with provisions for top and bottom entry of cables.

.3 When noted in the electrical one-line drawings, the AHF shall be incorporated into MCC or switchboard assemblies.

.2 Function of the AHF

.1 AHF shall monitor the total current of the loads under review utilizing two CT mounted on the supply AC lines for all three phase loads and all AHF. If phase to neutral loads are connected (four wire system), three CTs shall be required.

.1 AHF shall inject cancellation for every harmonic order from 2nd to 51st order. AHF with designs to inject less than all harmonic orders are unacceptable.

.2 AHF shall include an option to achieve optimized PF correction. Optimized PF correction is designed to prevent correction when the system PF is better (closer to unity) than the programmed PF setpoint. Any AHF that reduces the system PF to attain a reduced set point are unacceptable.

.2 AHF shall provide field selection as harmonic filter, reactive current correction, or supply current balancing or any combination of the three modes. All modes shall be required for this project.

.3 AHF shall provide for current balancing of AC supply for harmonic and reactive currents regardless of actual load distribution per phase.

.4 AHF shall have up to 30 seconds of logic ride through in the event of power loss.

.5 AHF shall be designed with a current limiting function to protect the IGBT.

.1 When the current limit level is attained on any harmonic order, a message shall be displayed indicating the output capacity is operating at maximum capacity.

.2 Operation shall continue indefinitely at this reduced level without trip or degradation of AHF.

.6 AHF shall have automatic restart capability upon power loss return and fault resets.

.1 Fault trip limit shall occur after five restarts within a 5-minute period and provide positive shut down and notice thereof.

.7 Upon occurrence of the fault trip limit, AHF shall stop output current production and lock out restart until the fault is manually cleared.

.8 AHF shall incorporate an over temperature output roll back that shall reduce the total output current to reduce power component heating in order to maintain maximum current correction at the elevated temperatures within the electrical system.

.1 AHF shall monitor the incoming air temperature and invoke a hard trip of the unit at 124°F (51°C).

.9 AHF shall be compatible with SPD, EMC filters, SCR (thyristor) snubber circuits, and switched mode power supplies (SMPS).

.3 Operator Interface

.1 AHF shall have a door mounted human machine interface (HMI) with touch screen control rated NEMA 12 (or IEC rated IP equivalent), dust tight and liquid resistant.

.2 HMI shall provide run/stop control from every screen.

.3 HMI shall provide an oscilloscope feature to display specific parameters.

.1 Three sets of data may be monitored at a time. Up to twenty predefined parameters can be chosen for each curve.

.2 Performance trend curves shall be displayed for load total RMS current, load RMA harmonic current per phase, AHF harmonic current output per phase, AC mains voltage per phase, THDi, TDD, load RMS reactive current, and AHF RMS reactive current output.

.3 Bar graphs shall be provided for display of the mains and load harmonic current amplitudes per harmonic order.

.4 Selected internal curves shall be provided for diagnostic and performance checks

.4 HMI shall display operating and setup parameters and event/fault messages in plain English, no cryptic codes or symbols are permitted on the display.

.1 HMI shall display the mains voltage and CT current.

.2 Parameter adjustment shall be made via HMI and shall be password protected.

.3 HMI shall record and display an event log with time and date stamp. Event log shall be cleared via the stop function or power-off. A minimum of 100 events shall be stored.

.5 HMI shall provide external communications via an RJ45 connectors.

.1 Modbus TCP/IP shall provide remote run/stop and display of operating parameters, set up parameters and diagnostic functions.

.6 HMI shall have a safety feature that shall lock out all other forms of control during service and commissioning.

.1 After 15 minutes of non-use the lockout shall clear, and control functions shall revert to full functionality and remote-control capability.

.7 HMI shall display a flashing warning screen in the event of a fault.

.8 HMI shall download pertinent parameters to a USB memory device to permit remote diagnostic evaluations and to save unit set up parameters.

.9 HMI shall include, but shall not be limited to, an on-board commissioning guide with automatic detection features.

.1 AHF shall automatically check for proper AC line phase rotation. No specific phase rotation is required.

.2 AHF shall automatically test for CT phase rotation and polarity. If installation is incorrect, AHF shall be able to rotate and reorient CT's through its own logic calculation. If proper alignment cannot be achieved, a fault warning and lockout of operation shall occur.

.3 AHF shall automatically calibrate the CT for optimum harmonic cancellation performance.

.4 AHF shall perform at full capacity for a period of 15 minutes to validate components meet temperature performance requirements in the installed location.

.5 In the event any of the above cannot be reconciled, HMI shall lock out AHF function until commissioning agent corrects, verifies, and clears each test.

2.3 External Current Transformer

.1 Split core type current transformers shall be installed as defined herein and as shown on the Electrical Drawings.

.2 Primary current ratings of the CT's shall be 200A (minimum).

.3 Current transformer ratio shall be as shown on the electrical on-line drawings. Secondary rating shall be 5 amperes.

.4 Current transformers rated for 50-60 hertz shall be used.

.5 Class 1 (or better) accuracy shall be provided.

Part 3 EXECUTION

3.1 Installation

.1 Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.

.1 Install low voltage active harmonic filters in accordance with the CEC and all applicable federal, provincial, and local codes.

3.2 Testing

.1 See Section 26-08-10 (Electrical Starting and Testing – General Requirements)

.2 Field inspection and testing shall be performed by certified technician from the manufacturer.

3.3 Demonstration

.1 See Section 26-08-40 (Electrical Equipment and Systems – Demonstration and Instruction)

.2 Provide the services of a factory authorized service representative of the manufacturer to provide start up service and to demonstrate and train the Owner's personnel.

.1 Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

.2 Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.

.3 Review data in operation and maintenance manuals with the Owner's personnel.

END OF SECTION

Part 1 GENERAL

1.1 General Requirements

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts

.3 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.1 Related Work Specified in Other Sections

.1 Electrical General Requirements: Section 26-00-10

1.2 Work Included

.1 This section includes for supply and installation of luminaires, lamps, ballasts, supports and accessories.

1.3 Coordination With Other Sections

.1 Confirm compatibility and interface luminaires with other materials and ceiling system. Report discrepancies to the Owner's Representative and defer ordering until clarified.

.2 Coordinate work with other trades to avoid conflicts between luminaires, supports and fittings and mechanical equipment. Do not suspend fixtures from mechanical equipment, pipes, or ducts.

1.4 Shop Drawings

.1 Comply with requirements of Section 26-00-10 (Electrical General Requirements)

.2 Provide shop drawings for luminaires. Include all pertinent physical characteristics. Manufacturers standard catalogue literature, clearly marked, may be used where applicable. Provide photometric data for each fixture and lamp combination.

1.5 Luminaire Designations

.1 Luminaire designations and configurations are detailed on the drawings.

Part 2 PRODUCTS

2.1 Luminaires

.1 Provide luminaires and lighting products as detailed within the luminaire designations detailed on the drawings.

Part 3 EXECUTION

3.1 General

.1 Replace defective units up to three (3) months after final acceptance.

.2 Replace any noisy LED drivers.

3.2 Supports

.1 Support fixtures directly from building structure by rod hangers and inserts except for T-bar mounted type.

.2 Install full length strut channel to align fixtures when suspended.

3.3 Pole mounted luminaires:

.1 Where luminaires are noted to be mounted on structural supports and/or structural poles, provide luminaires c/w mounting hardware and support arms as specifically noted and as required to attach to supports/poles.

3.4 Luminaire Wiring

.1 Connect recessed luminaires to outlet boxes with 2m of 2/12 BX RW90 cable.

.2 Connect interior surface or suspended luminaires with TECK cable.

3.5 Adjustment and Cleaning

.1 Align luminaires and clean all lenses/diffusers prior to final completion.

END OF SECTION

DIVISION 31

EARTHWORKS

1 General

1.1 SECTION INCLUDES

.1 Topsoil materials.
.2 Subsoil materials.

1.2 REFERENCES

.1 AASHTO T180 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and an 457 mm (18 inch) Drop.
.2 ASTM D698-07E1 - Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN/m((12,400 ft - lb/ft()).
.3 ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
.4 ASTM D1557-07 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN - m/m((56,000 ft - lb/ft()).
.5 ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
.6 ASTM D2487-06E1 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
.7 ASTM D6938-08a - Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS FOR REVIEW

.1 All imported surface and subsurface soil materials require approval from the Consultant prior to use.
.2 Samples: Submit, in air-tight containers, sample of each type of imported fill to testing laboratory engaged by the Owner.
.3 Materials Source, Classification, and Use: Submit name of imported materials source, imported soil material classification, and intended use of the material.
.4 Submit samples minimum 4 weeks prior to commencement of work.

1.4 QUALITY ASSURANCE

.1 Perform Work in accordance with applicable standards and regulations.

1.5 STORAGE AND PROTECTION

.1 Prevent damage to surrounding terrain and existing Work.
.2 Repair damage for no additional cost.

2 Products

2.1 TOPSOIL MATERIALS

.1 Native topsoil materials shall be used whenever possible for surface restoration.
.2 Imported surface soil materials shall require testing and approval from the Consultant prior to use.

2.2 SUBSOIL MATERIALS

.1 Native subsoil materials shall be used whenever possible or as indicated.
.2 Imported subsoil materials shall require testing and approval from the Consultant prior to use if not specified elsewhere in this contract.
.3 Specified course and fine aggregate materials to Section 31 05 16 - Aggregate Materials.

2.3 SOURCE QUALITY CONTROL

.1 If tests of imported materials indicate that they do not meet specified requirements, change material and retest.

.2 Provide materials of each approved type of imported soil from the same source throughout the Work.

3 Execution

3.1 SOIL REMOVAL AND HANDLING

.1 Proper excavation procedures are required to ensure that native soil materials can be re-used.
.2 Topsoil stripping to Section 31 12 13 - Site Clearing.
.3 Remove lumped soil, boulders, and rock.
.4 After trench backfilling, contour the subsoil to match the surrounding landscape profile to restore existing drainage patters. Prior to replacing topsoil, rip subsoil during drying conditions.
.5 Remove excess material not being used from site and dispose of material in designated areas.
.6 Minimize traffic in areas with soils that are susceptible to compaction, especially when soils are wet.

3.2 STOCKPILING

.1 Stockpile materials on site.
.2 Stockpile in sufficient quantities to meet Project schedule and requirements.
.3 Separate differing materials with dividers (silt fences) or stockpile apart to prevent mixing.
.4 Prevent intermixing of soil types or contamination.
.5 Direct surface water away from and stabilize stockpiled materials to prevent erosion or deterioration of materials.
.6 Minimize the creation of dust from stockpiled materials by using a tackifier if required.
.7 Erosion and sedimentation control measures shall be used by the Contractor on all stockpiles to mitigate the loss, movement, and cross contamination of adjacent lands with stockpiled materials.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Aggregate materials to be supplied and incorporated into the Work.

1.2 REFERENCES

.1 AASHTO - M147 - Materials for Aggregate and Soil-Aggregate.
.2 AASHTO T180 - Moisture-Density Relations of Soils Using a 4.54 kg Rammer and an 457 mm Drop.
.3 ASTM C136-06 - Method for Sieve Analysis of Fine and Coarse Aggregates.
.4 ASTM D698-07E1 - Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN/m((12,400 ft - lb/ft()).
.5 ASTM D1557-07 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN - m/m((56,000 ft - lb/ft()).
.6 ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
.7 ASTM D2487-06E1 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
.8 ASTM D6938-08a - Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).
.9 ASTM D4318-05 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS FOR REVIEW

.1 All imported aggregate materials require approval from the Consultant prior to use.
.2 Samples: Submit, in air-tight containers, sample of each type of imported aggregate material to testing laboratory engaged by the Owner.
.3 Materials Source, Classification, and Use: Submit name of imported materials source, imported soil material classification, and intended use of the material.
.4 Submit samples minimum 4 weeks prior to commencement of work.

1.4 STORAGE AND PROTECTION

.1 Prevent damage to surrounding terrain and existing Work.
.2 Repair damage for no additional cost.

2 Products

2.1 AGGREGATE MATERIALS - GENERAL

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.
.2 Flat and elongated particles are those whose greatest dimension exceeds five times their least dimension.

2.2 20 mm WASHED ROCK

.1 20 mm Washed Rock that meets the following particle size limits:

Seive Size	% Passing
20.0 mm	100
16.0 mm	75 to 100
12.5 mm	65 to 90
5.0 mm	35 to 55

2.0 mm	0

.2 Gradation to be within the limits specified when tested to ASTM C136 and ASTM C117 and having a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 Course aggregates satisfying these requirements shall be either crushed rock or gravel, washed, and composed of naturally formed particles of stone.

2.3 BEDDING SAND

.1 Bedding Sand that meets the following particle size limits:

Sieve Size	% Passing
10.0 mm	100
5.0 mm	50 to 100
2.0 mm	30 to 90
0.4 mm	10 to 50
0.08 mm	0 to 10

.2 Gradation to be within the limits specified when tested to ASTM C136 and having a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 Bedding Sand to be natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.4 DRAINAGE AGGREGATE (FOR USE BELOW FOUNDATION SLAB OF RESERVOIR)

.1 Rock that meets the following particle size limits:

Seive Size	% Passing
20.0 mm	100
10.0 mm	60 to 100
5.0 mm	44 to 90
2.0 mm	20 to 80
0.8 mm	0 to 53
0.4 mm	0 to 32
0.16 mm	0 to 10
0.08 mm	0 to 3

.2 Gradation to be within the limits specified when tested to ASTM C136 and ASTM C117 and having a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 Course aggregates satisfying these requirements shall be either crushed rock or gravel and composed of naturally formed particles of stone.

2.5 BASE COURSE (AB TRANSPORTATION DESIGNATION 2, CLASS 25)

.1 Rock that meets the following particle size limits:

Seive Size	% Passing
80.0 mm	-
50.0 mm	-
25.0 mm	100
20.0 mm	82 to 97
16.0 mm	70 to 94

10.0 mm	52 to 79
5.0 mm	35 to 64
1.25 mm	18 to 43
0.630 mm	12 to 34
0.315 mm	8 to 26
0.160 mm	5 to 18
0.080 mm	2 to 10

.2 Gradation to be within the limits specified when tested to ASTM C136 and ASTM C117 and having a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 Course aggregates satisfying these requirements shall be either crushed rock or gravel and composed of naturally formed particles of stone. Plasticity Index shall be 0 to 6%, CBR (min.) shall be 80, % fracture (min.) shall be 60%.

2.6 SUB-BASE COURSE (AB TRANSPORTATION DESIGNATION 6, CLASS 80)

.1 Rock that meets the following particle size limits:

Seive Size	% Passing
50.0 mm	100
25.0 mm	85 to 100
18.0 mm	80 to 100
12.5 mm	70 to 100
5.0 mm	50 to 85
2.0 mm	35 to 75
0.90 mm	25 to 50
0.40 mm	15 to 35
0.16 mm	8 to 22
0.07 mm	0 to 13

.2 Gradation to be within the limits specified when tested to ASTM C136 and ASTM C117 and having a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 Course aggregates satisfying these requirements shall be either rock or gravel and composed of naturally formed particles of stone. Plasticity Index shall be 0 to 8%, CBR (min.) shall be 25.

3 Execution

3.1 STOCKPILING

.1 Stockpile materials on site.

.2 Stockpile in sufficient quantities to meet Project schedule and requirements.

.3 Separate differing materials with dividers (silt fences) or stockpile apart to prevent mixing.

.4 Direct surface water away from and stabilize stockpiled materials to prevent erosion or deterioration of materials.

.5 During winter operations, prevent ice and snow from contaminating stockpile.

.6 Minimize the creation of dust from stockpiled materials by using a tackifier if required.

.7 Erosion and sedimentation control measures shall be used by the Contractor on all stockpiles to mitigate the loss, movement, and cross contamination of adjacent lands with stockpiled materials.

3.2 FIELD QUALITY CONTROL

.1 Allow testing authorities to access the site for testing of aggregate samples, when requested.

.2 Bear the cost of re-testing samples, where initial field tests reveal unsatisfactory

aggregate.

3.3 STOCKPILE CLEANUP

.1 Remove unused materials from site and ensure stockpile areas are reclaimed in accordance with the contract specifications.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies requirements for supply and installation of non-woven synthetic filter fabric to be used for separation.

1.2 MILL CERTIFICATES

.1 At least one (1) week prior to start of work, furnish Consultant with copies of mill test data and certificate that filter fabric delivered to job site meets requirements of this Section.

1.3 SUBMITTALS

.1 Submit shop drawings and product information prior to ordering material to be incorporated into the works.

1.4 APPROVAL

.1 Obtain written approval of Consultant for filter fabric use before installation of material in work.

2 Products

2.1 MATERIAL AND PERFORMANCE

.1 Synthetic fibre: rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents.

.2 Fabric: non-woven construction supplied in rolls of minimum 3.0 m width 50 m lengths, minimum thickness of 3.0 mm and minimum weight of 280 g/sq.m.

.3 Seams: welded or sewn.

.4 Physical properties:

- .1 Breaking load and elongation: to ASTM D4632 Grab Test Method, grab tensile strength 800 N minimum.
- .2 Grab tensile elongation = 50%.
- .3 Mullen Burst Strength = 2200 kPa minimum.
- .4 Permittivity = 1.5 sec^-1.

.5 Equivalent opening size (EOS): ASTM sieve size 0.14 mm. Determine by sieving successively coarser oven dried sand fractions of sand composed of sound rounded particles. EOS is "retained on" sieve size fraction of which less than 5% by weight passes filter fabric.

2.2 MANUFACTURER

.1 Nilex 4552 as manufactured by Nilex.

3 Execution

3.1 INSTALLATION

.1 Place material by unrolling on to graded surface, stretch taunt and retain in position in accordance with manufacturer's installation instructions using approved materials.

.2 Protect fabric from displacement or damage until and during placement of overlaid material layers.

.3 Place fabric on sloping surfaces in one continuous length from toe of slope to upper extent of fabric.

.4 Overlap each successive strip of fabric 500 mm over previously laid strip.

.5 Remove and replace fabric damaged or deteriorated as directed by Consultant.

.6 Do not permit passage of any vehicle directly on filter fabric at any time.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Removal of surface debris.
.2 Removal of trees, shrubs, and other plant life.
.3 Topsoil stripping.

1.2 REGULATORY REQUIREMENTS

.1 Conform to applicable codes for environmental requirements.
.2 Coordinate clearing Work with utility companies and Work by others.

2 Products

2.1 MATERIALS

.1 Not Used.

3 Execution

3.1 PREPARATION

.1 Verify that existing plant life designated to remain is tagged or identified. Consult landowner stipulations and conditions to verify what vegetation is to remain in any given section of land.
.2 Verify topsoil stripping requirements.
.3 Use areas as directed by Consultant for placing removed materials.

3.2 PROTECTION

.1 Locate, identify, and protect existing utilities from damage.
.2 Protect trees, plant growth, and features designated to remain.
.3 Protect bench marks, survey control points, from damage or displacement.
.4 Provide and maintain permanent and temporary roadways, walkways and detours for vehicular and pedestrian traffic.
.5 Ensure adjacent watercourses and water bodies are protected against potential contamination and sedimentation.
.6 Consult landowner stipulations and conditions to verify other items that require protection on any given section of land.

3.3 CLEARING

.1 Clear areas required for access to site and execution of Work.
.2 Remove trees and shrubs within construction area if necessary and only within the footprint required.
.3 Clear undergrowth and deadwood, without disturbing subsoil.
.4 Avoid, if possible, clearing vegetation during the breeding bird season - April 15 to July 31.

3.4 REMOVAL

.1 All debris resulting from the clearing operation becomes the property of Contractor. Unless specified in the Landowner stipulations and conditions. Debris may include rock and extracted plant life from site or wood mulch.
.2 Remove all cleared material unless directed otherwise.

3.5 TOPSOIL STRIPPING

.1 Do not excavate wet topsoil.

.2 The Contractor shall separate the topsoil from the subsoil in all areas that require soil salvage.

.3 Multiple lift soil handling techniques shall be used in locations where required.

.4 Strip topsoil from the trench and spoil side of the right-of-way on cultivated lands and from the trench only on other land uses that have a well established sod layer. Stockpile topsoils separately from subsoils for reclamation.

.5 The Owner may engage the services of a qualified soils specialist to determine if the multiple lift soil handling techniques are required. Contractor shall allow soils specialist access to the site for testing when requested to do so.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Removal of topsoil and subsoil.
.2 Cutting, grading, filling, the site for site structures and access roads.

1.2 REFERENCES

.1 AASHTO T180 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
.2 ASTM C136 - Method for Sieve analysis of Fine and Coarse Aggregates.
.3 ASTM D698-07E1 - Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN/m (12,400 ft - lb/ft)).
.4 ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
.5 ASTM D1557-07 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN - m/m (56,000 ft - lb/ft)).
.6 ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
.7 ASTM D2419 - Test Method for Sand Equivalent value of soils and Fine Aggregate.
.8 ASTM D2434 - Test Method for Permeability of Granular Soils (Constant Head).
.9 ASTM D2922 - Test Method for Density of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).
.10 ASTM D3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 PROJECT RECORD DOCUMENTS

.1 SECTION 01 33 00 – Submission procedures.
.2 Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts and slope gradients.

1.4 REGULATORY REQUIREMENTS

.1 Work shall be performed in safe practice conforming to Alberta Occupational Health and Safety Act (OH & S Act).

2 Products

2.1 MATERIALS

.1 Native topsoil materials shall be used whenever possible for surface.
.2 Imported surface soil materials shall require testing and approval from the Consultant prior to use.

3 Execution

3.1 EXAMINATION

.1 Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

.1 Identify required lines, levels, contours and datum.
.2 Stake and flag locations of known utilities minimum of five (5) days prior to commencing work.
.3 Locate, identify and protect utilities that remain, from damage.
.4 Notify utility company to remove and/or relocate utilities.
.5 Protect above and below grade utilities that remain.
.6 Protect plant life, lawns, rock outcropping and other features remaining as a portion of

final landscaping.

.7 Protect bench marks, survey control point, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

.8 The Contractor may be charged the costs of repeating reestablishments of survey control markers due to Contractor's careless site activates, at Owner's discretion..

3.3 SUBSOIL EXCAVATION

.1 Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.

.2 Excavate and process wet material to obtain optimum moisture content.

.3 When excavating through roots, perform work by hand and cut roots with sharp axe.

.4 Stockpile excavated material in accordance with Section 31 05 13. Remove from site, subsoil not being reused.

.5 Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.

.6 Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 FILLING

.1 Fill areas to contours and elevations with unfrozen material.

.2 Place fill material on continuous layers no more than 150 mm of compacted thickness and compact to 98% Standard Proctor at or slightly above the optimum moisture content.

.3 Maintain optimum moisture content of fill material to attain required compaction density.

.4 Slope grade away from building minimum 1.5:100, unless noted otherwise.

.5 Make grade changes gradual. Blend slope into level areas.

.6 Remove surplus fill material from site.

3.5 TOLERANCES

.1 Top surface of subgrade: Plus or minus 30 mm from required elevation.

3.6 FIELD QUALITY CONTROL

.1 Section 01 45 00: Field inspection and testing.

.2 Testing: In accordance with ASTM D2922.

.3 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

.4 Frequency of Tests: as requested by Consultant.

END OF SECTION

1 General

1.1 SECTION INCLUDES
.1 Final grade topsoil for finish landscaping.

1.2 REGULATORY REQUIREMENTS
.1 Work shall be performed in safe practice conforming to Alberta Occupational Health and Safety Act (OH & S Act).

2 Products

2.1 MATERIALS
.1 Topsoil: Fill Type S3 as specified in Section 31 05 13.

3 Execution

3.1 EXAMINATION
.1 Verify building and trench backfilling have been inspected.
.2 Verify substrate base has been contoured and compacted.

3.2 SUBGRADE PREPARATION
.1 Eliminate uneven areas and low spots.
.2 Remove debris, roots, branches, and stones in excess of 13 mm in size. Remove subsoil contaminated with petroleum products.
.3 Scarify surface to depth of 75 mm where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL
.1 Place 150 mm of topsoil in areas where seeding. Place topsoil during dry weather.
.2 Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
.3 Remove roots, weeds, rocks and foreign material while spreading.
.4 Manually spread topsoil close to plant life, to prevent damage.
.5 Lightly compact placed topsoil.
.6 Remove surplus subsoil and topsoil from site.
.7 Leave stockpile area and site clean and raked ready to receive landscaping.

3.4 TOLERANCES
.1 Top of Topsoil: Plus or minus 13 mm.

3.5 PROTECTION
.1 Protect landscaping and other features remaining as final work.
.2 Protect existing structures.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Excavating trenches for watermains.
.2 Compacted fill from top of utility bedding to subgrade elevations.
.3 Backfilling and compaction.

1.2 REFERENCES

.1 AASHTO T180 - Moisture-Density Relations of Soils Using a 4.54 kg Rammer and a 457 mm Drop.
.2 ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
.3 ASTM D698-07E1 - Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN/m (12,400 ft - lb/ft)).
.4 ASTM D1556-07 - Test Method for Density of Soil in Place by the Sand-Cone Method.
.5 ASTM D1557-07 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN - m/m (56,000 ft - lb/ft)).
.6 ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
.7 ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
.8 ASTM D3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS FOR REVIEW

.1 Section 01 33 00 - Submittal Procedures.
.2 All imported aggregate/backfill materials require approval from the Consultant prior to use.
.3 Samples: Submit, in air-tight containers, sample of each type of imported aggregate/backfill material to testing laboratory engaged by the Owner.
.4 Materials Source, Classification, and Use: Submit name of imported materials source, imported soil material classification, and intended use of the material.
.5 Geotextile Fabric Data: Proposed product meeting the specifications of Section 31 05 19 – Non-Woven Filter Fabric.
.6 Submit samples minimum 4 weeks prior to commencement of work.

1.4 DEFINITIONS

.1 Solid Rock: Material excavated from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass. Boulders or rock fragments having individual volume in excess of 0.5 cubic metres.
.2 Muck: Mixtures of soils and organic matter not suitable for foundation materials regardless of moisture content.
.3 Common Material: Deposits other than solid rock and muck.
.4 Imported Granular Backfill: Material, as specified and approved by the Consultant, imported to replace excavated material as backfill.
.5 Bedding Material: Materials, as specified and approved by the Consultant, used in the pipe zone.
.6 Extra Bedding Material: Extra bedding material ordered by the Consultant over bedding material included with pipe laying.
.7 Pipe Zone: Area of trench including and surrounding pipe as indicated on drawings.
.8 Topsoil: Material capable of supporting good agricultural growth and suitable for use in surface restoration.
.9 Untraveled Areas: Areas where vehicular or foot traffic do not regularly occur or are not anticipated at the completion of construction.
.10 Travelled Areas: Areas where vehicular or foot traffic may be anticipated including road, lanes, parking areas, driveways, pedestrian areas and road shoulders. Road shoulders

beside paved roads are areas accessible to vehicular traffic within 3 m from edge of pavement. Road shoulders beside gravel roads are accessible to vehicular traffic within 3 m from the normally travelled roadway.

1.5 SAFETY REQUIREMENTS

.1 Adhere to municipal and provincial requirements relating to safety of trenching work.

.2 Blasting, and the use of explosives is not permitted.

1.6 PROTECTION

.1 Existing Buried Utilities

.1 Size, depth and location of existing utilities shown on drawings are for guidance only; completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify applicable utility authorities, establish location and state of use of buried services. Clearly mark such locations to prevent disturbance during work.

.3 Adhere to stipulations and conditions of crossing agreement if applicable.

.4 Maintain and protect from damage all utilities encountered.

.2 Existing Surface Features

.1 Protect identified existing surface features where indicated. Repair to Owner's satisfaction any damage which may occur.

.2 Adhere to Landowner stipulations and conditions listed on drawings.

.3 Shoring and Bracing

.1 Whenever shoring, sheeting, timbering and bracing of excavations is required, engage services of a professional engineer to design and assume responsibility for adequacy of shoring and bracing. Professional engineer shall be registered in the Province of Alberta.

.2 When requested by the Consultant, submit for review drawings and calculations signed and stamped by the professional engineer responsible for their preparation.

.3 Close sheeting, when required, to be designed and constructed to prevent adjacent soil or water from entering excavation.

.4 Access: Maintain unobstructed access to fire and police appurtenances, telephone, electric, water, sewer, gas or other public utilities and private properties.

.5 Flooding: Protect open excavation against flooding and damage from surface water runoff.

1.7 FIELD MEASUREMENTS

.1 Verify that survey bench mark, control point, and intended elevations for the Work are as shown on drawings.

2 Products

2.1 FILL MATERIALS

.1 Imported Backfill:

.1 Medium or medium to high plastic clay, approved by the Geotechnical Engineer may be used as fill material if the native material is deemed unsuitable.

.2 Native Backfill:

.1 Approved material selected from trench excavation or other source, unfrozen and free from cinders, ashes, sods, refuse or other deleterious materials and with the natural water content within 5% of the optimum value for the proctor compaction specified, based on the native soil which is being used for backfill.

.3 Bedding Materials:

.1 Coarse or fine aggregate material as specified in Section 31 05 16 - Aggregate

Materials.

3 Execution

3.1 PREPARATION

.1 Identify and verify required benchmarks, lines, levels, contours, and datum locations.
.2 Locate, identify, and protect existing utilities from damage.
.3 Notify utility companies in accordance with crossing agreements.
.4 Protect vegetation and other identified features that are to remain.
.5 Protect bench marks, survey control points, existing structures, from excavating equipment and vehicular traffic.
.6 Maintain and protect above and below grade utilities which are to remain.
.7 Strip topsoil in accordance with Section 31 12 13 - Site Clearing.
.8 Cut out soft areas of subgrade not capable of compaction in place. Backfill with imported granular backfill and compact to density equal to or greater than requirements for subsequent backfill material.

3.2 DEWATERING

.1 Keep excavations dry while work is in progress.
.2 Dewater excavations as required.

3.3 EXCAVATING

.1 Excavate subsoil required for watermain.
.2 Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
.3 Hand trim excavation. Remove loose matter.
.4 Remove lumped subsoil, boulders, and rock up to 0.5 cubic metres, measured by volume.
.5 Notify Consultant with subsoil at proposed elevation of trench bottom appears to be unsuitable for foundation or bearing surfaces.
.6 Correct areas of over excavation and restore surfaces.
.7 Stockpile excavated material in area designated on site and remove excess material not being used, from site.
.8 Unless otherwise authorized by the Consultant, do not excavate more than 30 m of trench in advance of installation operations and do not leave the trench open at the end of a days operation.

3.4 TRENCH BOTTOM PREPARATION

.1 Where required, due to removal of unsuitable material or unauthorized over-excavation, bring bottom of excavation to design grade with approved material.
.2 Compact trench bottom to a density at least equal to density of adjacent surrounding soil.

3.5 PRE-INSTALLATION INSPECTION

.1 Excavations require inspection and approval prior to commencement of installation operations.

3.6 BACKFILLING

.1 Backfilling and compaction in accordance with Section 31 23 24 - Backfilling for Trenches.

3.7 FIELD QUALITY CONTROL

.1 Section 01 45 00 - Quality Control: Field inspection and testing.
.2 Compaction testing will be performed in accordance with ASTM D2922.
.3 If tests indicate Work does not meet specified requirements, remove Work, replace,

compact, and retest.

.4 Frequency of Tests: one test for per lift of backfill per 100 lineal meters of pipe minimum.

.5 Frequency of testing may be increased by Consultant based on observed soil conditions.

3.8 SURFACE RESTORATION

.1 Replace topsoil as directed by Consultant or soils specialist.

.2 Restore travelled areas to match existing as required.

.3 Clean and reinstate areas affected by work as directed.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Trench backfilling to subgrade elevations.
.2 Fill for over-excavation.
.3 Aggregate particles larger than 4.75 mm.
.4 Consolidation and compaction.

1.2 REFERENCES

.1 AASHTO T180 - Moisture-Density Relations of Soils Using a 4.54 kg Rammer and a 457 mm Drop.
.2 ASTM C127-01 - Test Method for Density, Relative Density (Specific Gravity), and Absorption of Course Aggregate.
.3 ASTM D698-07E1 - Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN/m (12,400 ft - lb/ft)).
.4 ASTM D1556-07 - Test Method for Density of Soil in Place by the Sand-Cone Method.
.5 ASTM D1557-07 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN - m/m (56,000 ft - lb/ft)).
.6 ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
.7 ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
.8 ASTM D3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
.9 ASTM D4253 (00 - Test methods for maximum Index density and Unit Weight of Solids Using a Vibratory Table.

1.3 SUBMITTALS FOR REVIEW

.1 Section 01 33 00 - Submittal Procedures.
.2 All imported aggregate/backfill materials require approval from the Consultant prior to use.
.3 Samples: Submit, in air-tight containers, sample of each type of imported aggregate/backfill material to testing laboratory engaged by the Owner.
.4 Materials Source, Classification, and Use: Submit name of imported materials source, imported soil material classification, and intended use of the material.
.5 Geotextile Fabric Data: Proposed product meeting the specifications of this Section.
.6 Submit samples minimum 4 weeks prior to commencement of work.

1.4 DEFINITIONS

.1 Solid Rock: Material excavated from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass. Boulders or rock fragments having individual volume in excess of 0.5 cubic metres.
.2 Muck: Mixtures of soils and organic matter not suitable for foundation materials regardless of moisture content.
.3 Common Material: Deposits other than solid rock and muck.
.4 Imported Granular Backfill: Material, as specified and approved by the Consultant, imported to replace excavated material as backfill.
.5 Bedding Material: Materials, as specified and approved by the Consultant, used under the mechanical structures.
.6 Extra Bedding Material: Extra bedding material ordered by the Consultant over bedding material included as specified.
.7 Topsoil: Material capable of supporting good agricultural growth and suitable for use in surface restoration.
.8 Untraveled Areas: Areas where vehicular or foot traffic do not regularly occur or are not anticipated at the completion of construction.

.9 Travelled Areas: Areas where vehicular or foot traffic may be anticipated including road, lanes, parking areas, driveways, pedestrian areas and road shoulders. Road shoulders beside paved roads are areas accessible to vehicular traffic within 3 m from edge of pavement. Road shoulders beside gravel roads are accessible to vehicular traffic within 3 m from the normally travelled roadway.

1.5 PERFORMANCE REQUIREMENTS

.1 Corrected Maximum Dry Density: The following applies to aggregate particles larger than 4.75 mm, by adjusting standard maximum dry density as follows:
- .1 Formulae: D = (F1 x D1) + (0.9 x D2 x F2).
- .2 Where: D = corrected maximum dry density kg/cu m.
- .3 Where: F1 = fraction (decimal) of total field sample passing 4.75 mm sieve.
- .4 Where: F2 = fraction (decimal) of total field sample retained on 4.75 mm sieve (equal to 1.00 - F1).
- .5 Where: D1 = maximum dry density, kg/cu m of material passing 4.75 mm sieve determined with Method A of ASTM D1557.
- .6 Where: D2 = bulk density, kg/cu m of material retained on 4.75 mm sieve, equal to 1000 G (where G is bulk specific gravity (dry basis) of material when tested to ASTM C127).
- .7 For free draining aggregate, determine D1 (maximum dry density) to ASTM D4253, dry method when directed by Consultant.

2 Products

2.1 FILL MATERIALS

.1 Imported Backfill:
- .1 Medium or medium to high plastic clay, approved by the Geotechnical Engineer may be used as fill material if the native material is deemed unsuitable.

.2 Native Backfill:
- .1 Approved material selected from trench excavation or other source, unfrozen and free from cinders, ashes, sods, refuse or other deleterious materials and with the natural water content within 5% of the optimum value for the proctor compaction specified, based on the native soil which is being used for backfill.

.3 Bedding Materials:
- .1 Coarse or fine aggregate material as specified in Section 31 05 16 - Aggregate Materials.

3 Execution

3.1 EXAMINATION

.1 Verify that damp proofing or waterproofing installation has been inspected.
.2 Verify that insulation installation has been inspected.
.3 Verify that mechanical couplings and concrete penetrations have been inspected.
.4 Verify structural ability of mechanical structure walls to support imposed loads by the fill.

3.2 PREPARATION

.1 Compact subgrade to density requirements for subsequent backfill materials.
.2 Cut out soft areas of subgrade not capable of compaction in place. Backfill with imported granular backfill and compact to density equal to or greater than requirements for subsequent fill material.
.3 Scarify subgrade surface to identify soft spots; fill and compact to density equal to or

greater than requirements for subsequent fill material.

3.3 PRE-INSTALLATION INSPECTION

.1 Excavations require inspection and approval prior to commencement of installation operations.

3.4 BACKFILLING

.1 Do not proceed with backfilling operations until Consultant has inspected and approved trenching and installations.

.2 Use approved native or imported backfill material as indicated or directed.

.3 Backfilling:

.1 Place non-woven filter fabric, if required, over prepared subgrade.

.2 Place bedding and surrounding material as specified and compact.

.3 Do not backfill around or over cast-in-place concrete within 24 hours after placing.

.4 Place backfill layers simultaneously on both sides of installed work to equalize loading.

.5 Place material by hand around installations and in pipe zone until 300 mm of cover is provided. Dumping backfill material directly on installations will not be permitted.

.4 Do not place backfill material in freezing weather without written authorization of the Consultant.

.5 Shoring, sheeting and bracing:

.1 Unless otherwise indicated, or directed by Consultant, remove sheeting and shoring from excavation during backfilling operations.

.2 Do not remove bracing until backfilling has reached the elevation of the bracing.

.3 Pull sheeting in 150 mm increments until clear of installations, simultaneously placing and compacting backfill to fill voids left by pulled sheeting.

.4 Pull sheeting thereafter in increments that will ensure backfill is maintained at an elevation at least 450 mm above toe of sheeting.

.5 When sheeting is to remain in place, cut off tops at elevations indicated or directed.

.6 Place backfill material above pipe zone in uniform layers not exceeding 300 mm in compacted thickness up to subgrade elevation. Compact each layer before place succeeding layer to the specified compaction level shown on the contract drawings. Each layer may be subjected to compaction testing at the direction of the Consultant. Any deficiencies found in the level of compaction achieved shall be corrected by the Contractor at his expense.

.7 Maintain optimum moisture content of backfill materials to attain required compaction density.

.8 Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

.9 Compact each layer of backfill to the specified compaction levels shown on the contract drawings.

.10 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified levels of minimum compaction.

.12 Backfill excavation to contours and elevations with unfrozen fill materials to restore natural drainage patterns.

.13 Remove surplus fill materials from site.

3.5 TOLERANCES

.1 Top Surface of Backfilling under Travelled Areas: Plus or minus 25 mm from required elevations.

.2 Top Surface of General Backfilling: Plus or minus 25 mm from required elevations.

3.6 FIELD QUALITY CONTROL

.1 Section 01 45 00 - Quality Control: Field inspection and testing.

.2 Compaction testing will be performed in accordance with ASTM C127 and/or ASTM D2922.

.3 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

.4 Frequency of Tests: one test for per lift of backfill.

.5 Frequency of testing may be increased by Consultant based on observed soil conditions.

3.7 SURFACE RESTORATION

.1 Replace topsoil as directed by Consultant or soils specialist.

.2 Restore travelled areas to match existing as required.

.3 Clean and reinstate areas affected by work as directed.

END OF SECTION

DIVISION 32

EXTERIOR IMPROVEMENTS

1 General

1.1 DESCRIPTION

.1 This section specifies requirements for placing topsoil from stockpiles existing within or near contract limits that have been stockpiled as part of this or other contracts, or for supplying and placing additional topsoil as required.

.2 Work includes, but is not necessarily limited to: preparation of surfaces to receive topsoil, supplying and spreading topsoil in areas and to the depths shown on plans and as designated by Consultant, fertilizing, fine grading, and the restoration of stockpile sites.

1.2 SAMPLES AND TESTING

.1 The Owner shall be responsible for testing topsoil from on-site sources. For Contractor supplied topsoil the Contractor shall supply to the Consultant a one (1) litre sample of topsoil for testing at least 4 weeks prior to commencing work.

.2 The soil shall be tested at the Owner's expense and the soil test results will be furnished to the Contractor one week before commencement of work. Soil additives (fertilizer, lime, etc.) as recommended by the soil test results will be considered part of the Contract price for Contractor supplied topsoil. When a source of topsoil is exhausted, topsoil from a new source shall not be used until tested and approved by the Consultant.

1.3 PROTECTION

.1 Prevent damage to fencing, trees natural features, bench marks, existing buildings, existing pavement, and utility lines which are to remain. Make good any damage at Contractor's expense.

2 Products

2.1 MATERIALS

.1 On site topsoil: as stripped and stockpiled, free from vegetation, sub soil, gravel, sand, or other extraneous materials and free from stones and clods or clumps over 25 mm in greatest dimension.

.2 Imported topsoil to be supplied if required: a fine friable medium loam, neither heavy clay nor of a very light sandy nature, capable of sustaining good agricultural growth, meeting following requirements:

- .1 Containing min 4% organic matter for clay loams and min 2% for sandy loams. Peat moss to be added if minimum organic matter is not present.
- .2 Acidity range pH of 6.0 to 7.5. Apply ground agricultural limestone or sulphur to adjust pH to the required level.
- .3 Free of sub soil, roots, vegetation, weed seeds, stones larger than 25 mm in greatest dimension, or any other extraneous material.
- .4 Topsoil containing noxious weeds is not acceptable.
- .5 Electrical conductivity shall be 3 4 mhos per cm^2.

.3 Lime:

- .1 Ground agricultural limestone containing min 85% of total carbonates.
- .2 Gradation requirements, percentage passing by weight, 90% passing No. 1000 sieve, 50% passing No. 125 sieve.
- .3 Transport and store in unopened waterproof containers, labelled showing weight, analysis and name of manufacturer.
- .4 Use limestone as indicated by acidity analysis of topsoil to bring pH to required level.

3 Execution

3.1 SURFACE PREPARATION

.1 Fine grade to within 50 mm of design and roughen or lightly scarify areas to receive topsoil. Eliminate uneven areas and low spots, ensuring positive drainage. Filling depressions with topsoil is not permitted.
.2 Remove debris, roots, vegetation, stones and other debris.
.3 Remove sub soil that is contaminated with oil, fuels and solvents. Dispose of removed materials as directed.
.4 Cultivate sub soil to a min depth of 75 mm. Repeat this cultivation in those areas where equipment used for hauling and spreading has compacted sub soil.

3.2 SPREADING TOPSOIL

.1 Do not spread topsoil until Consultant has inspected and reviewed the subgrade.
.2 Do not place topsoil on frozen or wet surfaces or when topsoil is in a wet, muddy or frozen condition.
.3 Spread topsoil in areas and to depths indicated or directed.
.4 Rake and clean topsoil of debris, roots, vegetation, and stones larger than 25 mm in greatest dimension. Remove as directed.
.5 Manually spread topsoil around trees and plants to prevent damage by grading equipment.

3.3 SOIL AMENDMENTS

.1 Apply lime, sulphur or other soil amendment at rate determined from soil sample test.
.2 Mix soil amendment well into full depth of topsoil by cultivating or roto tilling prior to application of fertilizer.

3.4 APPLICATION OF FERTILIZER

.1 Apply fertilizer at least one week after lime application and at least six days before sodding or seeding.
.2 For Contractor supplied topsoil, spread fertilizer over entire area of topsoil at rate determined on basis of soil sample test. For Owner supplied topsoil apply 27-14-0 fertilizer at 3 kg/100 m2. Use mechanical spreaders only.
.3 Mix fertilizer thoroughly into upper 50 mm of topsoil.

3.5 FINISH GRADING

.1 Fine grade entire topsoil area to contours and elevations indicated on plans or as directed, eliminating rough spots and low areas ensuring positive drainage.
.2 Leave surface smooth, uniform, firm against deep foot printing, with a fine loose texture.

3.6 RESTORATION OF STOCKPILE SITES

.1 Restore stockpile sites within or adjacent to contract limits to a "rake clean" condition acceptable to Consultant.

3.7 CLEAN UP

.1 Dispose of debris raked from topsoil off of site.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies requirements for supplying and placing nursery sod or field sod on a prepared topsoil bed.

1.2 SOURCE SAMPLING

.1 At least 2 weeks prior to commencing work designate to Engineer proposed source of sod and provide Engineer with access to such source for inspection, sampling and testing.

1.3 ACCEPTANCE

.1 Acceptance of material at its source does not prevent subsequent rejection on job site.

.2 Work to be accepted when:

- .1 Growth of sodded areas has been properly established.
- .2 Sodded areas have been cut twice.
- .3 Turf is free of bare and dead spots and without weed growth.
- .4 No surface soil is visible when grass has been mowed to a height of 40 mm.

.3 20% of the total value of sodding shall be withheld until all the conditions of 1.4.2 and 3.4 are fulfilled.

1.4 DELIVERY AND STORAGE

.1 Schedule deliveries in order to keep storage at job site to minimum without causing delays.

.2 Deliver, unload and store rolled sod on pallets only.

.3 Deliver sod to site within 24 hours of being lifted and lay sod within 36 hours of being lifted.

.4 Do not deliver small, irregular or broken pieces of sod.

.5 During wet weather allow sod to dry sufficiently to prevent tearing during lifting and handling.

.6 During dry weather protect sod from drying and water sod as necessary to ensure its vitality and prevent dropping of soil in handling. Sod which dries out to be rejected.

1.5 SCHEDULING OF WORK

.1 Schedule sod laying to coincide with topsoil operations.

2 Products

2.1 MATERIALS

.1 When proposed source of sod is approved, use no other source without written authorization by Engineer.

.2 Sod especially sown and cultivated in nursery field as turf grass crop containing maximum of 2% of other grass species or clover than variety specified, and maximum of two broad leaf weeds and ten other weeds within 40 square metre area. Thickness of soil portion of sod not to exceed 25 mm or be less than 20 mm. Sod with soil visible when grass is mowed to 40 mm height is not acceptable. Bluegrass and Fescue grass sod shall be minimum 60 percent Kentucky Bluegrass, 30 percent creeping red fescue and maximum 5 percent perennial rye grass or 10 percent Red Top. Both rye grass and Red Top may be included.

.3 Weed killer:

- .1 Type 1: 2,4-D Amine for broadleaf plants.
- .2 Type 2: Fenoprop (silvex) or equivalent for clover, chickweed and other 2,4-D

resistant weeds.

.4 Wooden stakes: 17 x 17 x 300 mm.

.5 Fertilizer

.1 Complete commercial fertilizer (27-14-0) with minimum 50 percent of elements derived from organic sources.

3 Execution

3.1 CONDITION OF SURFACES

.1 Obtain Engineer's approval of topsoil grade and depth before starting sodding.

.2 Lightly loosen surface of topsoil that has become compacted.

3.2 LAYING SOD

.1 Spring sodding not to commence later than June 15 and fall sodding not to commence earlier than August 15 or later than September 15 in same year.

.2 Do not lay sod during dry summer period, under freezing temperatures, or on frozen or excessively wet soil.

.3 Lay sod in rows at right angles to slopes, smooth, even with adjoining areas and with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp knife. Tearing of sod is not permitted.

.4 Roll lightly to provide close contact between sod and soil. Heavy rolling to correct irregularities in grade is not permitted. Tamp edges smooth and flush with adjoining grass areas, paving, top surfaces of curbs, etc.

.5 Water immediately after sod laying and obtain a moisture penetration through sod into top 100 mm of topsoil.

.6 Provide adequate protection of sodded areas against damage. Remove this protection after lawn areas have been accepted by Engineer.

3.3 STAKING SOD

.1 On slopes of 1.75:1 to 3:1 secure bottom three rows of sod and every third row thereafter with wooden stakes.

.2 On slopes steeper than 1.75:1 secure each and every row of sod with wooden stakes and use chicken wire if necessary.

.3 Place stakes close enough to prevent sod from shifting but at intervals of not more than 600 mm.

.4 Drive stakes flush with sod soil surface.

3.4 MAINTENANCE

.1 Maintain sodded areas until turf is well established and accepted by Engineer.

.2 Apply water to ensure establishment and continuous growth of sod. Apply sufficient water to ensure a moisture penetration of 75 to 100 mm.

.3 Mow grass when it reaches a height of 65 mm. Cut grass thereafter frequently enough to be kept at a height of 40 to 50 mm. Remove clippings which will smother the grass.

.4 Apply weed killer when weeds start developing in competition with grass. Apply according to manufacturer's instructions. Do not apply during high winds. Keep pressure in spray equipment low to prevent drifting. Apply when temperature is above 10 degrees C. Repair damage caused by weed killer application.

.5 Approximately one month after laying, fertilize sodded areas with 27-14-0 at the rate of 3kg/100m^2. Spread fertilizer evenly over area and water area well. Postpone fertilizing until next spring if application falls within 4 week period prior to expected end of growth season in locality.

END OF SECTION

DIVISION 33

UTILITIES

1 General

1.1 SECTION INCLUDES

.1 This section specifies the requirements for the supply and installation of precast.

2 Products

2.1 MATERIALS

.1 Concrete:
- .1 To Division 03 - Concrete.
- .2 Cement: to CAN3 A5, Sulfate resistant (Type 50).
- .3 Concrete mix design to produce minimum compressive strength of 25 MPa at 28 days and containing 25 mm maximum size coarse aggregate, with water/cement ratio to CAN3 A23.1, table 7 for class A exposure and 150 mm slump at time and point of deposit. Air entrainment to CAN3 A23.1, table 8 for class A exposure.

.2 Concrete reinforcement: to Section 03 20 00.

.3 Precast structures shall be made watertight utilizing gaskets, link seals, and cement mortar or approved sealant where applicable or as noted on drawings.

.4 Mortar:
- .1 Aggregate: to CSA A82.56.
- .2 Cement: to CAN3 A8, Sulfate resistant (Type 50).

.5 Ladder rungs: 20 mm diameter galvanized preformed steel rungs (drop step type).

.6 Adjusting rings: to ASTM C478. Maximum of 3 rings on any structure.

.7 Frames, gratings, covers to plan dimensions and following requirements:
- .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
- .2 Gray iron castings to ASTM A48 strength class 30B.
- .3 Castings to be sand blasted or cleaned and ground to eliminate surface imperfections.

.8 Safety Platforms (if required) shall consist of 2 piece removable aluminum grates supported on aluminum frames designed to fit in the standard manhole joint.

3 Execution

3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Division 31 - Earthwork.

.2 Obtain approval by the Consultant before installing precast structures.

3.2 CONCRETE WORK

.1 Do concrete work in accordance with Division 03 - Concrete.

.2 Place concrete reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 Position metal inserts to dimensions and details indicated.

3.3 INSTALLATION

.1 Construct units to details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.

.3 Pump excavation free of standing water and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undisturbed ground or when permitted by Engineer, set precast concrete base on a minimum of 30 - 100mm granular material, compacted to a minimum density of 95% Standard Proctor.

.5 For Precast Units:
- .1 Set bottom section and each successive section using "O" ring joints and rubber gaskets to produce a watertight joint.
- .2 Plug lifting holes with concrete plugs set in cement mortar or mastic compound.

.6 Installing units in existing systems:
- .1 Where a new unit is to be installed in an existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
- .2 Make joints watertight between new unit and existing pipe.
- .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready to be put in operation, complete installation with appropriate break outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.7 Set frame and cover to required elevation using 2 - 4 concrete rings to a maximum of 350mm. Make joints smooth and watertight by parging with cement mortar.

.8 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

1 General

1.1 SECTION INCLUDES

.1 The work covered by this section involves the installation of water connections and all other associated work.

1.2 RELATED SECTIONS

.1 Section 31 23 16 Excavating

.2 Section 31 23 18 Trenching

.3 Section 31 23 23 Backfilling

2 Products

2.1 WATER SERVICE PIPE

.1 Piping for building water services shall be in accordance with the following table and be CSA certified:

SERVICE SIZE (mm)	MATERIAL	STANDARD	MINIMUM RATING
All sizes 50 and smaller	Copper-Type K soft Drawn	AWWA C800, ANSI/NSF 61	1100 kPa (160 psi)

2.2 WATER SERVICE APPURTENANCES

.1 Service Saddles

.1 Full circle type, constructed of fully passivated T304 stainless steel with BUNA-N or EPDM gaskets and T304 stainless steel bolts with rolled threads and nuts. Not to be used for AC or CI pipe without full circle gaskets.

.2 Repair Clamps

.1 Constructed of fully passivated T304 stainless steel with BUNA-N or EPDM gaskets and 304 stainless steel bolts with rolled threads and nuts, min width 300mm.

.3 Unions

.1 Standard brass compression type, adaptable to the size and type of pipe used.

.4 Curb Stops and Boxes

.1 50mm and smaller

.1 Low lead bronze or brass body, stop and waste design, globe or ball valve style, with compression type end connections designed for the specific pipe type(s) being joined.

.2 Curbs stops shall be Mueller B25209, Mueller Type H 15219, Mueller Type H15182, Ford Model B44, or as approved.

.3 Curb boxes and top extensions shall be Sch. 40 Type 304 stainless steel pipe complete with polymer boot.

.4 The Curb box covers shall be Mueller Type A808 ribbed cover complete with standard pentagon plug No. 143469 or as approved.

.5 Curb box rods shall be Type 304L stainless steel, 13 mm diameter with standard pigtail to fit standard 25 mm I.D. curb box.

.6 Cold forge u-shape complete with hole for brass cotter pin to fit 20 mm to 50 mm curb stops.

.7 Curb box cover, ribbed cover with standard pentagon brass plug.

.5 Protective Tape Coating

.1 Petrolatum primer and cold applied petrolatum tape conforming to AWWA C217 latest edition - (Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections and Fittings for Steel Water Pipeline)

.6 Tapping Sleeves and Valves.

.1 Tapping sleeves shall be split body, full circle type with body, stub pipe and flange constructed of fully passivated T304 stainless steel with BUNA-N ring seal and BUNA-S liner. Inside diameter of outlet connection to be at least equivalent to that of standard weight steel pipe of the same nominal size. Sleeve bolts and nuts to be stainless steel to ASTM A193/A194-B8 or B8M. Threads to be Teflon coated. Outlet flange 150lb ANSI, flat-faced.

.2 Tapping sleeves shall be ROBAR Series 6066, ROMAC SST, or as approved.

.3 Tapping valves resilient seated gate valve, having a clear passage at least equivalent to the inside diameter of the connecting stub on the tapping sleeve being used and, certified by the manufacturer as suitable for use as a tapping valve.

2.3 TAPPING MACHINE

.1 Tap water mains using a Mueller direct tapping machine meeting industry standards (Refer to *Tapping Guide How to Tap Blue Brute Pipe* by IPEX) and approved by the Engineer.

.2 Water mains shall be tapped using a Mueller Model B-100, Model B-101, Model A3, Ford Model 77 or as approved.

3 Execution

3.1 WATER SERVICE CONNECTIONS

.1 Water services piping up to and including 50 mm may be installed in a common trench with the sanitary sewer service line. A clear separation of at least 300mm should be maintained between these lines.

.2 Whenever common trenched service lines must be installed at different elevations, install the higher service on a shelf of undisturbed ground. If shelving the higher service line is not possible, re-establish the foundation of the higher utility with compacted backfill.

.3 Leave trenches open until connections up to and including those 25 mm in diameter have been completed and visually inspected while they are under pressure. Ensure corporation stops are in the open position before backfilling.

.4 Install residential service connections on the property line at the locations shown on the drawings. Install a short length of copper pipe on the private side of the curb stop and crimp. Install services to existing buildings along a line that will best suit the interior plumbing. Provide a gooseneck with a minimum radius of 600 mm immediately adjacent to the corporation stop on all service connections 40 mm and smaller. Refer to Standard Drawing for arrangement details.

.5 Unless otherwise specified, tap corporation stops into the watermain using an approved Mueller tapping machine while the main is under normal operating pressure. After completion of each tapping connection, backfill to 75 mm above the top of the gooseneck with material as specified in Section 33 10 14 – Trench Excavation and Backfill

.6 Provide minimum 2.7 m of cover over the full length of service lines.

3.2 TAPPING WATERMAINS

.1 Conditions for Tapping Asbestos Cement Pipe

.1 Use an approved tapping sleeve.
.2 Tapping size shall be two (2) nominal pipe sizes smaller than the watermain being connected to.

.2 Conditions for Tapping Ductile Iron, Cast Iron or Steel Pipe

.1 Where tapping of ductile iron, cast iron, or steel pipe is required, it will be as directed by the Engineer.

.3 Conditions for Tapping PVC Pipe

.1 Use an approved tapping sleeve.
.2 Tapping size used on PVC pipe shall be at least one (1) nominal pipe size smaller than the watermain being connected to.
.3 Size on size tap as approved by the Owner. Submit shop drawings for tapping sleeve. Size on size taps will not be permitted on any asbestos cement or cast iron pipes.

PVC					
DR18 PVC Pipe (mm)	150	200	250	300	400
Tap Size (mm)	**TAPPING METHOD**				
20	1	1	1	1	1
25	1	1	1	1	1
40	2	2	2	2	2
50	2	2	2	2	2
100	3	3	3	3	3

Where: 1 = Direct tap

2 = Tap through an approved service saddle

3 = Tap through an approved tapping sleeve

3.3 PROTECTIVE TAPE COATING

.1 Surface shall be clean, dry and at least 5 ºC before any coating materials are applied.

.2 Store, handle and apply coating materials according to the manufacturer instructions and climatic and substrate condition requirements.

3.4 SERVICE PIPE POSITIONING

.1 Position the service pipe in the trench as follows when facing the building.

$$\frac{Left}{Storm} \quad \frac{Centre}{Domestic} \quad \frac{Right}{Water}$$

3.5 WATER SERVICE

.1 Direct Tapping of Watermain with Corporation Stops–50 mm and smaller

.1 Refer to Standard Drawing. Install the corporation stop in the top quadrant of the watermain at an angle of between 30^{o} to 60^{o} above the horizontal unless noted otherwise.

.2 Do not tap corporation stops into watermains within 600 mm of a pipe joint, fitting or valve. Space multiple taps a minimum of 450 mm on centre.

.3 Tighten corporation stops into asbestos-cement and ductile iron watermains with 70 to 80 Newton-meters of torque with 1 to 3 threads showing. Tighten corporation stops into PVC watermains (cast iron O.D. only) with 35 to 40 Newton-Meters of torque.Wrap the thread of the corporation stops used on PVC and ductile iron watermains with three to four wrappings of teflon pipe thread tape before installation of the corporation stop.

3.6 CURB STOPS

.1 On services 50mm and smaller install a curb stop and waste at the property line.

.2 Install curb stop and waste valves with the drain port on the private property side, extend a short length of copper pipe from it and crimp the end. Refer to Standard Drawing W-17.

.3 Install services to existing buildings along a line that will best suit the interior plumbing.

.4 Support each curb stop and waste on a 75 mm x 200 mm x 250 mm concrete block as shown on Standard Drawing. Install gate valves as shown on Standard Drawings.

.5 In fine-grained or clay soils construct a 0.2 m^3 volume drainage sump below and around each curb stop and waste.

.6 When curb stops or valves are installed and the boxes are to be installed later, mark the curb stop or valve above ground as shown on Standard Drawing.

.7 Adequately secure the curb extension rod to each curb stop and waste. Set the service box plumb with the upper sections of the service box adjusted to grade elevation. Install the lower section of the service box and the extension rod a minimum 300 mm below ground elevation to prevent heavy loads being transmitted to the curb stop. Leave the curb stops closed.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Hydrostatic pressure and leakage testing of sewage forcemains.

.2 Testing and reporting results.

1.2 RELATED SECTIONS

.1 Section 33 11 24 HDPE Forcemain

1.3 REFERENCES

1.4 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data on equipment, pipe materials, pipe fittings, accessories, to be used for the Work of this Section.

.2 Test Reports: Indicate results comparative to specified requirements for all specified testing.

1.5 PROJECT RECORD DOCUMENTS

.1 Hydrostatic pressure and leakage report requirements:
- .1 Date and time of hydrostatic pressure and leakage testing start and time of completion.
- .2 Test locations.
- .3 Initial pressure, final pressure, and calculated leakage for each section of main tested.

1.6 QUALITY ASSURANCE

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable codes or regulations for performing the work of this Section.

2 Products

2.1 WATER FOR TESTING

.1 The Contractor shall provide the testing water for the hydrostatic tests on any section of main.

3 Execution

3.1 EXAMINATION

.1 Verify that forcemain system is ready for the Work of this Section.

.2 Schedule hydrostatic pressure and leakage testing in consultation with the Owner and Consultant. Owner and Consultant may choose to witness all or part of testing required for the Work of this Section.

3.2 HYDROSTATIC PRESSURE AND LEAKAGE TESTING

.1 Required equipment shall be as follows:
- .1 ANSI Standard B40.1-1974 Grade A, or equivalent, Bourdon tube pressure gauge with acceptable range with an accuracy of 1% of the full-scale reading. The pressure gauge calibration shall be certified by the Contractor.
- .2 Motor powered pump capable of meeting the required test pressures including necessary plumbing accessories for preventing backflow and for enabling the flow rate to be controlled. The pump shall have a pressure relief valve. The pump shall be dedicated for the purposes of the testing and shall not be used for any other activities.
- .3 Water storage tanks shall be on non-corrosive material dedicated to the testing.

.2 Inform the Consultant and Owner of the date, time, and location of the hydrostatic pressure and leakage testing at least one week prior to the test time. Failure to notify Consultant and Owner shall result in the tests being unacceptable.

.3 Prior to any testing, ensure that all main valves in the test section are open.

.4 Prior to any testing, ensure that any recently poured concrete that is adjacent to the forcemain and used for support has had sufficient time to cure and achieve the required strength.

.5 All boundary valves must be operated by the Owner.

.6 The hydrostatic test procedure consists of two stages; the initial expansion stage and the test stage.
- .1 Initial filling stage for HDPE forcemain:
  - .1 Fill the forcemain with water and bleed off any trapped air.
  - .2 Pressurize the test section to test pressure and add sufficient make-up water at each hour for four (4) hours to return the section of forcemain to the test pressure.
  - .3 Test pressure shall be 160 PSI.
  - .4 Calculate and record this test pressure.
  - .5 Make-up volume of water required for initial expansion stage shall be recorded, however, it shall not factor into the allowable leakage test.
  - .6 Initial expansion stage should be complete after four (4) hours and the section of forcemain should be holding the test pressure. Once test pressure is being held by the section of forcemain being tested, the initial expansion stage is over and the test stage can begin.
- .2 Test stage for HDPE Forcemain:
  - .1 Calculate and record the pressure that would be equivalent to a 68.9 kPa (10 psi) reduction drop in the pressure from 3.2.6.1.4 above. This pressure is now the target test pressure.
  - .2 Drop the pressure in the section of forcemain being tested by 68.9 kPa (10 psi).
  - .3 Record the time when the specified target test pressure has been achieved, this is the start time of the test.
  - .4 To pass the test, the section of forcemain being tested shall maintain the target test pressure within 5% of the required value for one (1) hour.
  - .5 Record the time and final pressure at the end of the one hour test period and verify that it is within 5% of the target test pressure.

.3 Under no circumstances shall the total time under test pressure (initial expansion stage plus test stage) exceed eight (8) hours. If the test is not completed within this time limit due to leakage or equipment failure, the pressure shall be bled off and the section of forcemain under test shall be permitted to relax for a minimum of eight (8) hours prior to any re-testing. Contractor is responsible for all costs related to any repairs that need to be made to correct any deficiencies and for re-testing.

.7 For the hydrostatic pressure and leakage testing required for this Section of the contract, the sections of forcemain to be tested will be approved by the Consultant prior to the work commencing.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies requirements for supplying and installing gravity sanitary sewer pipe and service connections.

1.2 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.
.2 Submit schedule of expected interruptions and adhere to approved schedule.
.3 Notify Engineer a minimum of 24h in advance of any interruption in service.
.4 Provide temporary flow control as required

2 Products

2.1 CONCRETE PIPE

.1 Reinforced circular concrete pipe: CAN/CSA-A257.2 and designed for flexible rubber gasket joints.
.2 Rubber gaskets to be confined "O" ring and shall meet the specification of ASTM C443.

2.2 PLASTIC PIPE

.1 Type PSM Poly (Vinyl Chloride) to CSA-B182.2.
    .1 Standard Dimensional Ratio (SDR) 35, unless indicated otherwise on the drawings.
    .2 Separate gasket and integral bell system.
    .3 All joints to meet the requirements of Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastromeric Seals (ASTM D3212).
    .4 Nominal lengths, 6m.

2.3 POLYETHYLENE PIPES

.1 For pipe sizes 100mm and less
        .1 Pipe, fittings and joints to CSA B137.1.
        .2 PE compound: PE 3408
        .3 Series as specified on drawings
.2 For pipe sizes 100mm to 1575mm
        .1 Pipe, fittings, and joints to AWWA C906-90.
        .2 PE compound: PE 3408
        .3 Dimension ratio as specified on drawings.
        .4 Cast iron fittings with flanged ends to: CSA 131.9.

2.4 SERVICE CONNECTIONS

.1 Plastic pipe to CSA B182.1-M with push-on joints.
.2 Plastic service saddles and tees.
.3 All clamps and/or metal fasteners to be stainless steel.

2.5 CEMENT MORTAR

.1 Portland cement: to CAN 3-A5-M Sulfate resistant (Type 50).
.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

2.5 PIPE BEDDING MATERIALS

.1 Granular materials, general.
    .1 Gradation shall be within specified limits when tested to ASTM C136 and ASTM C117 (AASHTO T11 and T27) and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.
.2 Bedding Sand:
    .1 Natural sand or crushed rock screenings to following grading requirements:

Sieve Size	Percent Passing
10.0mm	100
5.0mm	50 - 100
2.0mm	30 - 90
0.40mm	10 - 50
0.08mm	0 - 10

.3 Bedding Stone: crushed stone or crushed gravel to following grading requirements:

Sieve Size	Percent Passing
20.0mm	100
16.0mm	75 - 100
12.5mm	65 - 90
5.0mm	35 - 55
2.0mm	0

.4 Concrete required for cradles, encasement, supports; 20mPa sulfate resistant (Type 50) concrete to Section 03300 and/or Section 03305.

2.6 INSULATION

.1 If required in locations as shown on the drawings the pipe shall be field insulated with extruded polystyrene board, Type HI-60 or approved equal as detailed.

3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

3.2 TRENCHING AND BACKFILL

.1 Do trenching and backfill work in accordance with Section 02221.
.2 Trench line and depth require approval prior to placing bedding material and pipe.
.3 Do not backfill trenches until pipe grade and alignment have been checked and accepted.

3.3 GRANULAR BEDDING

.1 Place granular bedding materials in accordance with details indicated or directed.
.2 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
.3 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
.4 Compact full width of bed to at least 95% Standard Proctor Density.
.5 Use bedding stone in lieu of sand bedding material when directed. Use filter cloth to separate sand and bedding stone.
.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with bedding material.

3.4 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations.
.2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
.6 Do not allow water to flow through pipe during construction, except as may be permitted by Engineer.
.7 Whenever work is suspended, install a removable water tight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.

.9 Pipe Jointing:

.1 Install gaskets in accordance with manufacturer's recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes carefully before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 Block pipes as directed when any stoppage of work occurs to prevent creep during down time.

.11 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.

.12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.

.14 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint of saddle to pipe shall be structurally sound and watertight.

.15 Upon completion of pipe laying and after Engineer has inspected pipe joints, place specified granular material to dimensions indicated or directed and in accordance with the Contract Specifications

.16 Backfill remainder of trench in accordance with the Contract Specifications

3.5 SERVICE CONNECTIONS

.1 Install pipe to CSA B182.11 and manufacturer's standard instructions and specifications.

.2 Service connections to main sewer to be Engineer-approved saddles or tees. Do not use break-in and mortar patch-type joints.

.3 Service connection pipe shall not extend into interior of main sewer.

.4 Make up required horizontal and vertical bends from 45° bends or less, separated by a straight section of pipe with a minimum length of four pipe diameters. Use long sweep bends where applicable.

.5 Plug service laterals with watertight caps or plugs as approved.

.6 Place location marker at ends of plugged or capped unconnected sewer lines. Each marker shall consist of a 50 x 100mm stake extending from pipe end at pipe level to 1.0m above grade. Paint exposed portion of stake red with designation SAN SWR LINE in black.

3.6 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Engineer, draw a tapered wooden plug with a diameter of 50mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction. Use a plug 95% of inside diameter in PVC pipe test.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Do infiltration and exfiltration testing as directed. Perform tests in presence of Engineer. Notify Engineer 24h in advance of proposed tests.

.6 Carry out tests on each section of sewer between successive manholes including service connections.

.7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.8 Exfiltration test:

.1 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24h to ensure absorption in pipe wall is complete before test measurements are commenced.

.2 Immediately prior to test period add water to pipe line until there is a head of 1m over interior crown of pipe measured at highest point of test section or water in manhole is 1m above static groundwater level, whichever is greater.

.3 Duration of exfiltration test shall be two hours.

.4 Water loss at end of test period shall not exceed maximum allowable exfiltration over any section of pipe between manholes.

.9 Infiltration test:

.1 Conduct infiltration test in lieu of exfiltration test where static groundwater level is 750mm or more above top of pipe measured at highest point in line to be used.

.2 Do not interpolate a head greater than 750mm to obtain an increase in allowable infiltration rate.

.3 Install a watertight plug at upstream end of pipeline test section.

.4 Discontinue pumping operations for at least 3d before test measurements are to commence and during this time keep thoroughly wet at least one- third of pipe invert perimeter.

.5 Prevent damage to pipe and bedding material due to flotation and erosion.

.6 Place a 90° V-notch weir, or other measuring device approved by Engineer in invert of sewer at each manhole.

.7 Measure rate of flow over a minimum of 1h, with recorded flows for each 5 min interval.

.10 Infiltration or exfiltration shall not exceed following limits in litres per hour per 100m of pipe, including service connections.

Nominal Pipe Diameter in mm	PVC Pipe	Concrete Pipe
100	2.08	8.33
125	2.60	10.42
150	3.13	12.50
200	4.17	16.67
250	5.21	20.83
300	6.25	25.00
350	7.29	29.17
400	8.33	33.33
450	9.38	37.50
500	10.42	41.67
550	11.46	45.83
600	12.50	50.00
700	14.58	58.33
800	16.67	66.67
900	18.75	75.00
1000	20.83	83.33
1100	22.92	91.67
1200	25.00	100.00

Values shown in columns 2 and 3 are in litres per hour per 100 metres of pipe. These limits are based upon the following:

- 20L per day per mm diameter per 1km concrete pipe
- 5L per day per mm diameter per 1km PVC pipe

.11 Repair and retest sewer line as required, until test results are within limits specified.

.12 Repair visible leaks regardless of test results.

.13 Television and photographic inspections:

.1 Perform a camera survey of the installed sewers.

.2 Provide a video tape copy of the survey to the Engineer conforming to the

following:

.1 VHS format.

.2 Running audio commentary of each pipe run.

.3 Written report and still photos of problem areas.

.14 Repair any problem areas revealed by camera survey.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies the requirements for supplying and installing sewage forcemain pipe and appurtenances.

2 Products

2.1 MATERIALS

.1 Polyvinyl chloride class pipe: to CSA B137.3 and AWWA C900.
- .1 Standard dimensional ratio (SDR), as specified on drawings.
- .2 Pressure Class as specified on drawings.
- .3 Gasket bell end.
- .4 Pipe joints: bell and spigot with rubber gaskets, solvent welded joints or mechanical joints to CSA B131.1 with transition gaskets to pipe manufacturer's specifications.
- .5 Rubber gaskets: to ASTM F477.
- .6 Cast iron fittings: to CSA B131.1
- .7 PVC moulded fittings to CSA B137.2.

.2 Polyethylene pressure pipes:
- .1 For pipe sizes 100mm and less
  - .1 Pipe, fittings and joints to CSA B137.1.
  - .2 PE compound: PE 3408
  - .3 Series as specified on drawings
- .2 For pipe sizes 100mm to 1575mm
  - .1 Pipe, fittings, and joints to AWWA C906-90.
  - .2 PE compound: PE 4710
  - .3 Dimension ratio as specified on drawings.
  - .4 Cast iron fittings with flanged ends to: CSA 131.9.

.3 Polyvinyl chloride series pipe: to CSA B137.3 and ASTM D2241 or AWWA C905.
- .1 Standard dimensional ratio (SDR) as specified on drawings.
- .2 Series as specified on drawings.
- .3 Gasket bell end.
- .4 Pipe joints: bell and spigot with rubber gaskets, solvent welded joints or mechanical joints to CSA B131.10 with transition gaskets to pipe manufacturer's specifications.
- .5 Rubber gaskets to ASTM F477.
- .6 Cast iron fittings to CSA B131.1.
- .7 Moulded fittings to CSA B137.2.
- .8 PVC/Fibreglass reinforced fittings to CSA B137.3M.

2.2 PIPE BEDDING MATERIALS

.1 Granular materials:
- .1 Gradation shall be within specified limits when tested to ASTM C136 and ASTM C117 (AASHTO T11 and T27) and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.
- .2 Bedding sand:
  - .1 Natural sand or crushed rock screenings to following grading requirements:

Sieve Size	Percent Passing
10.0mm	100
5.0mm	50 - 100
2.0mm	30 - 90
0.40mm	10 - 50
0.08mm	0 - 10

.2 Liquid Limit: ASTM D423-66 (AASHTO T89), Maximum 25.
.3 Plasticity Index: ASTM D424-59 (AASHTO T90) Maximum 6.

.3 Bedding Stone: crushed stone or crushed gravel to following grading requirements:

Sieve Size	Percent Passing
20.0mm	100
16.0mm	75 - 100
12.5mm	65 - 90
5.0mm	35 - 55
2.0mm	15 - 45
1.25mm	0

.2 Concrete for thrust blocks: 20mPa Sulfate Resistant concrete (Type 50).

2.3 PIPE INSULATION

.1 Polyurethane insulation

.1 The insulation shall be in the thickness specified of polyurethane foam (k = 0.14 maximum). Polyurethane foam shall be a two component system identified as component "A"; a polymeric isocynate and component "b", a polyether premix containing 100 percent of the resin and catalyst and emulsifier with a blowing agent (Freon). Each batch must be chemically analyzed and must meet ASTM specifications D1638, D1786 and D2849.

.2 Two split insulation halves shall be supplied for each pipe length. Preformed split insulation halves precut to a length of 400mm shall be utilized for insulating the pipe joints.

3 Physical Properties of the Foam:

Property	ASTM Test	Min. or Max. Value
Core Density(Moulded)	ASTM D1622	40kg/m^3 max.
Overall Density(Moulded)		48kg/m^3 max.
Porosity(Closed Cell)	ASTM D2856	90% min.
Water Absorption	ASTM D2842	12g/1000 cc
Compressive Strength	ASTM D1621	205pa min.
Thermal Conductivity(Initial)	ASTM D2326	K Factor - 0.2 max W/(M °.C) at 25°

.2 Outer jacket protection:

.1 The outer jacket over the insulation shall be a high density polyethylene. Jacket material shall be continuously extruded. The standard minimum thickness of the outer jacket shall be 45 mils ± 10 percent.

.2 The outer jacket shall not chemically react with polyurethane foam. Material must have good soil stress characteristics, high resistance to salt water, abrasion and acids.

.3 A modified rubber mastic shall be continuously applied to the foam surface prior to the application of the polyethylene outer jacket to form a bond between the foam and outer jacket. The sealant shall not chemically react with the foam nor be applied at a temperature greater than 177°C.

.4 A polyethylene heat shrink sleave, compatible with the outer jacket is to be supplied for each pipe length, sized to overlap the performed insulation ends and to form a watertight seal when shrunk under the application of heat.

.5 Physical Properties of Outer Jacket

Property	ASTM Test	Min. or Max. Value
Colour		Black
Melt Index	ASTM D1238	0.45 gms/10 min. max.
Density	ASTM D1505	0.95 gms/cc
Tensile Yield*	ASTM D638**	2200 kgf/cm^2 min.
Elongation	ASTM D638**	400% min.

Hardness	ASTM D1706	45 Shore D min.
Izod Impact	ASTM D256	0.35 kgm/cm of notch min.
Brittleness	ASTM D746	-107°C
Vicat Softening Point	ASTM D1525	120°C
Carbon Black	ASTM D1603	2.0% min.
Escr (-50%)	ASTM D1693	30 m/hr. min.

* Cross head speed 50 mm/min.
** Die "C" of ASTM 412-62T.

2.4 AIR AND VACUUM RELEASE VALVES

.1 Air and vacuum valves: shall be as specified on the drawings.
- .1 The air and vacuum valve shall be of the float operated, compound leverage type, and capable of automatically releasing accumulated air from a fluid system while that system is in operation and under pressure.
- .2 To assure drop tight shut-off, a viton orifice button having an adjustable feature shall be used to seal the valve discharge orifice.
- .3 The float shall be of all stainless steel construction and capable of withstanding a pressure of 1035kPa.
- .4 The body cover shall be of cast iron construction with all internal trim to be of stainless steel or viton, consistent with the following specifications.
  Body and Cover - Cast Iron - A126 GR.B
  Float - Stainless Steel - ASTM A240
  Leverage - Stainless Steel - ASTM A240
  Mechanism - ASTM A276
- .5 Air and vacuum valves to be supplied c/w backflushing attachment and isolation valves.

2.5 VALVES AND VALVE BOXES

.1 Gate valves: to AWWA C500, standard iron body, bronze mounted wedge valves with non-rising stems, suitable for 1035kPa with suitable connection joints.
.2 Valves to open counter clockwise.
.3 Cast iron valve boxes: bituminous coated three piece sliding type adjustable over a minimum of 450mm complete with valve operating extension rod, 25 x 25mm cross section, of such length that when set on valve operating 50mm nut top of rod will not be more than 150mm below cover complete with a stone catcher flange. Base to be large round type with minimum diameter of 300mm.

3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 TRENCHING AND BACKFILL

.1 Do trenching and backfill in accordance with Division 31
.2 Trench alignment and depth require approval prior to placing bedding material or pipe.
.3 Do not backfill trenches between joints until pipe slope and alignment have been checked and accepted.

3.3 BEDDING

.1 Place bedding material to details indicated and compact to minimum density of 95% Standard Proctor.
.2 Use bedding stone in lieu of sand bedding material when directed.

3.4 INSTALLATION

.1 Lay pipes in accordance with AWWA C600 and manufacturer's recommendations. Do not use blocks to support pipe.
.2 Join pipes in accordance with AWWA C600 and manufacturer's recommendations.
.3 Avoid damage to machined ends of pipes in handling and moving pipe.
.4 Maintain grade and alignment of pipes.
.5 Align pipes carefully before jointing.
.6 Do not exceed maximum joint deflection recommended by pipe manufacturer unless directed in writing by Engineer. Use special bends where necessary to avoid joint deflection.
.7 Support pipe firmly over entire length, except for clearance necessary at couplings.
.8 Keep pipe and pipe joints free from foreign material.
.9 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Gaskets so disturbed to be removed, cleaned, lubricated and replaced before jointing is attempted.
.10 Support pipes by means of hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
.11 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.
.12 Snake polyethylene pipe in the trench to allow for thermal contraction.
.13 Apply restraint to forcemain to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Engineer.
.14 Block pipe as directed when any stoppage of work occurs to prevent creep during downtime.

3.5 THRUST BLOCKS

.1 Place concrete thrust blocks between bends, tees and fittings and undisturbed ground.
.2 Keep pipe couplings free of concrete.
.3 Bearing area of thrust blocks to be as indicated on drawings.

3.6 FIELD TESTING OF FORCEMAIN

.1 PVC Pipe
.1 Testing of forcemain to be carried out under supervision of Engineer.
.2 Before testing, bed and cover pipe between joints to prevent movement of forcemain when test pressure is applied.
.3 Expel air from forcemain, by slowly filling main with water. High points to be drilled and tapped and suitable cocks installed to vent air and to be shut when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fittings plugs.
.4 For C900 pipe apply a hydrostatic test pressure of 1035kPa. For series pipe test pressure to equal the series rating. Test pressure to be based on elevation of lowest point in line and corrected to elevation of test gauge.
.5 Define leakage as amount of water supplied in order to maintain test pressure for 2h.
.6 Do not exceed allowable leakage as defined in AWWA C600 using the following formula:
a) PVC Pipe $L = \frac{ND(p^{0.5})}{128320}$

P - test pressure (kPa) (1.0 PSI = 6.9 kPa)
D - nominal diameter (mm)
N - number of joints
L - leakage (litres per hour)

.7 Locate and repair defects if leakage is greater than amount specified in item 3.6.1.8.
.8 Repeat test until leakage is within specified allowance for full length of forcemain.
.9 If the forcemain - liftstation connection is to be made by others, drain line upon

successful completion of the leakage test.

.2 Polyethylene Pipe

.1 Testing of forcemain to be carried out under supervision of Engineer.

.2 Before testing, bed and cover pipe between joints to prevent movement of forcemain when test pressure is applied.

.3 Expel air from forcemain, by slowly filling main with water. High points to be drilled and tapped and suitable cocks installed to vent air and to be shut when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.

.4 Apply a hydrostatic test pressure of 1.5 times the rated pressure of the pipe (1.5 x series number) at the lowest point in the line.

.5 Pressurize pipe to required test pressure over a period of 3 hours and hold required test pressure for an additional hour to allow for pipe stretch prior to starting leakage test. A high-volume high-pressure pump may be required to raise the pressure within the allowable time.

.6 Test period shall be of two hours duration. The amount of make-up water (leakage) required to return the pipe to the test pressure shall not exceed the allowance given in the following table.

Nominal Pipe Size		Allowance for Expansion (Leakage)
mm	(litres/100 m of pipe)	
	1 Hour Test	2 Hour Test
75	1.2	1.7
100	1.5	2.9
150	3.5	6.9
200	5.8	11.5
250	8.6	15
300	13	26
350	16	32
400	19	38
450	25	50
500	32	63
550	40	81
600	52	103
700	63	128
800	81	165
900	104	208
1,050	138	276
1,200	173	310

.7 Total time under test must not exceed 8 hours. If the test is not completed because of leakage or equipment failure, the test section must be permitted to "relax" for 8 hours prior to the next testing sequence.

.8 Locate and repair defects if leakage is greater than amount specified in 3.6.2.6.

.9 Repeat test until leakage is within specified allowance for full length of forcemain.

.10 If the forcemain-lift station connection is to be made by others, drain line upon successful completion of the leakage test.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Passive cathodic protection.

.2 Anodes and attachment to buried metallic components.

1.2 REFERENCES

.1 ASTM B418 -2001 - Cast and Wrought Galvanic Zinc Anodes.

.2 NACE RP-01 -1999 (National Association of Corrosion Engineers) - Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems.

1.3 PERFORMANCE REQUIREMENTS

.1 Conform to NACE RP-01 standard.

.2 Iron and Steel Components:

.1 Negative voltage of 0.85 volts measured between component and saturated reference electrode contacting the earth near component.

.2 Negative voltage shift of 300 millivolts measured between component and saturated reference electrode contacting the earth near component.

.3 Polarization voltage shift of 100 millivolts measured between component and saturated reference electrode contacting the earth near component.

1.4 SUBMITTALS FOR REVIEW

.1 Shop Drawings: Indicate wiring diagrams.

.2 Product Data: Provide data for anodes.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

.1 Accurately record actual locations of anodes.

1.6 QUALIFICATIONS

.1 Installer: Company specializing in performing the work of this Section with minimum three years documented experience.

.2 Design system under direct supervision of a corrosion engineer experienced in design of this type of work.

.3 Design work by parties certified by National Association of Corrosion Engineers and licensed at the place of work. Submit proof of designer certification.

2 Products

2.1 MATERIALS

.1 Zinc Anode: ASTM B418 Type I, cast galvanic zinc, tape, bare weight of 5.5 kg.

.2 Anode Lead Wire: Solid copper conductor, 12 AWG, Type TW insulation.

2.2 ANODE BACKFILL

.1 High Performance Backfill: Blended granular mixture, 100 percent passing a 150 micro m sieve mesh screen; composed of the following:

.1 Hydrated Gypsum: 50 percent by weight.

.2 Bentonite Clay: 20 percent weight.

.3 Sodium Sulphate: 5 percent by weight.

.2 The nominal resistivity of the anode backfill shall be 50 Ohm-Cm.

3 Execution

3.1 EXAMINATION

.1 Verify buried pipe systems are completed and tested.

3.2 INSTALLATION

.1 Pack anode and backfill in cloth bag; centre anode and firmly pack backfill with mechanical vibrator. Use backfill material of a packaged weight 2.5 times the unit weight of the anode.
.2 Provide bonding to ensure protected components are electrically continuous.
.3 Connect system to metallic components to be protected by following manufacturer's recommended instructions for type of material being protected and soil conditions.
.4 Restore corrosion protective coatings and wraps damaged during installation.
.5 Coordinate the Work with placement of buried site metallic components requiring protection.

3.3 FIELD QUALITY CONTROL

.1 Conform to NACE RP-01.

END OF SECTION

DIVISION 34

TRANSPORTATION

1 General

1.1 DESCRIPTION

.1 This section specifies the requirements for road excavation, road drainage excavation, borrow excavation, embankment construction and disposal of material in accordance with specification and conforming to lines, grades, dimensions and typical cross sections shown on plans or established by Consultant.

1.2 DEFINITIONS

.1 Excavation classes:

- .1 Topsoil stripping: excavation and stockpiling of material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 Rock Excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulder or rock fragments having individual volumes in excess of 0.5 m 3.
- .3 Common excavation: excavation, placement and compaction in embankments of all on site materials whatever nature, which are not included under the definition of topsoil stripping, waste excavation, borrow excavation or rock excavation, including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .4 Waste excavation: excavation and removal from the site or disposed on site as designated by the Engineer of any material unsuitable for use in work or surplus to requirements.
- .5 Borrow excavation: excavation, delivery to the site, placement and compaction of suitable material obtained off site and used in embankment.

.2 Free haul: distance the common excavation is to be hauled without compensation. Free haul distance to be unlimited within 1 kilometre.

.3 Overhaul: authorized hauling of common excavation in excess of free haul distance that excavated material is moved.

.4 Embankment: material placed above original ground or in stripped or undercut areas up to subgrade elevation.

.5 Pavement structure: combination of layers of unbound or stabilized granular subbase, base, and asphalt or concrete surfacing.

.6 Subgrade elevation: elevation immediately below pavement structure.

1.3 TRAFFIC PROVISIONS

.1 Provide and maintain roadways, walkways and detours, for vehicular and pedestrian traffic as directed by Consultant.

2 Products

2.1 MATERIALS

.1 Not used.

3 Execution

3.1 COMPACTION EQUIPMENT

.1 Compaction equipment must be capable of obtaining required densities for materials on project. Equipment that does not achieve specified densities must be replaced.

3.2 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution and in a manner acceptable to

Consultant.

3.3 EXCAVATING

.1 General:
- .1 Advise Consultant sufficiently in advance of excavation operations for initial cross sections to be taken.
- .2 Maintain crowns, cross slopes, pumps or ditches to keep excavations free of running or standing water.

.2 Topsoil Stripping:
- .1 Strip topsoil from areas and to depths indicated or directed prior to beginning of excavation and embankment work. Avoid contamination of topsoil and underlying soil.
- .2 Topsoil excavated to be stockpiled in a location as directed by Consultant.

.3 Rock Excavation:
- .1 If during excavation, material appearing to conform to classification for rock is encountered, notify Consultant in sufficient time to enable measurements to be made to determine volume of rock.
- .2 Remove rock to 300 mm below sub grade elevation indicated.
- .3 Provide effective drainage to ditches, leaving no undrained pockets in foundation.
- .4 Scale down rock slopes and remove rock fragments which are liable to slide or roll down slopes.

.4 Waste Excavation:
- .1 Notify Consultant whenever unsuitable materials are encountered in cut or embankment sections and remove unsuitable materials to depth and extent directed.
- .2 Dispose of waste excavation at the designated waste site. If no waste site is designated dispose of material off site in an area located by Contractor and at his expense and approved by Consultant

.5 Borrow Excavation:
- .1 Completely use in embankments, suitable materials removed from excavations before taking material from borrow areas.
- .2 Obtain from borrow areas located on project property additional suitable embankment material.
  - .1 Consultant to designate location and extent of borrow areas, and allowable depth of cutting.
  - .2 Shape edges of borrow areas on slopes of 4:1 and provide drainage as directed.
  - .3 Trim and leave borrow pits in a condition to permit accurate measurement of material removed.
  - .4 Borrow area to be reclaimed in accordance with Alberta Environmental Protection Guidelines.

.6 Haul Routes:
- .1 Haul routes and hauling equipment to be approved by Consultant.
- .2 Keep haul routes clean and free of dust and spilled material.
- .3 Provide adequate traffic control and warning signs on haul routes to ensure safety of public.
- .4 Restore haul routes to original condition.
- .5 Borrow areas located by the Contractor, beyond the limits identified by the Engineer, are subject to approval by the Consultant. It shall be the Contractor's responsibility to obtain all the necessary approvals from the local Reclaimation Inspector of Alberta Environmental Protection, for the use and reclaimation of the borrow area.

3.4 SUBGRADE PREPARATION

.1 After excavation, backfill or fill has been completed, compact top 300 mm of roadway

subgrade to a density of 100% Standard Proctor.

.2 Remove soft or other unstable material that will not compact properly and fill resulting depressions with approved material.

.3 Shape and compact subgrade to within 13 mm of design elevations but not uniformly high or low.

.4 Do scarifying, blading, moisture adjustment, compacting or other methods of work as necessary to provide a thoroughly compacted subgrade shaped to grades and cross sections indicated or directed.

.5 Finish side slopes to a neat condition, suitable for seeding, true to lines and grades indicated.

.1 Remove boulders encountered in cut slopes and fill resulting cavities.

.2 Hand finish slopes that cannot be finished satisfactorily by use of machine.

3.5 PROOF ROLLING

.1 For proof rolling use a single axle dual wheeled truck loaded to minimum 9100 kg on the rear axle. Tires to be inflated to a minimum 275 kPa.

.2 Engineer may authorize use of other acceptable proof rolling equipment.

.3 Proof roll subgrade at the level directed by the Engineer.

.4 Where proof rolling reveals areas of defective subgrade, remove and replace to requirements of this section at no extra cost to the Owner.

3.6 MAINTENANCE

.1 Maintain road surfaces until next course of material is placed or until project or that portion thereof is accepted.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 This section specifies general requirements for supplying and processing aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregates are given in the related work sections.

1.2 SOURCE APPROVAL

.1 Source of materials to be incorporated into work or stockpiled requires approval.

.2 Inform Engineer of proposed source of aggregates and provide access for sampling at least 2 weeks prior to commencing production.

.3 If, in opinion of Engineer, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, procure an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.4 Should a change of material source be proposed during work, advise Engineer 2 weeks in advance of proposed change to allow sampling and testing.

.5 Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

1.3 PRODUCTION SAMPLING

.1 Aggregate will be subject to continual sampling during production.

.2 Provide Engineer with ready access to source and processed material for purpose of sampling and testing.

.3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.

2 Products

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.

.2 Flat and elongated particles are those whose greatest dimension exceeds five times their least dimension.

.3 Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

- .1 Natural sand.
- .2 Manufactured sand.
- .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.4 Coarse aggregates satisfying requirements of applicable section shall be one of following:

- .1 Crushed rock or slag.
- .2 Gravel composed of naturally formed particles of stone.

3 Execution

3.1 PROCESSING

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates if required to obtain gradation requirements specified. Use approved methods and equipment.

.3 Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.
.4 Wash aggregates, if required to meet specifications. Use only equipment approved by Engineer.

3.2 HANDLING

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

3.3 STOCKPILING

.1 Stockpile aggregates on site in locations indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.
.2 Stockpile aggregates in sufficient quantities to meet project schedules.
.3 Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials.
.4 Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than 300 mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.
.5 Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.
.6 Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.
.7 Stockpile materials in uniform layers of thickness as follows:
    .1 Max 1 m for coarse aggregate and base course materials.
    .2 Max 2 m for fine aggregate and sub base materials.
    .3 Max 1.5 m for other materials.
.8 Complete each layer over entire stockpile area before beginning next layer.
.9 Uniformly spot dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
.10 Coning of piles or spilling of material over edges of pile will not be permitted.
.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.4 STOCKPILE CLEANUP

.1 Leave stockpile site in a tidy, well drained condition, free of standing surface water.
.2 Remove any unused aggregates as directed.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 This section specifies requirements for supplying, producing, placing and compacting pitrun gravel or quarried stone as a granular base or sub base to lines, grades and typical cross sections indicated on plans or as directed.

2 Products

2.1 MATERIALS

.1 Scarified and salvaged old pavement materials approved by Engineer.

.2 Pitrun material to Section 02230 and following requirements:

.1 Gradation to be within the limits specified for the (4) four types of granular material specified hereinafter, when tested to ASTM C136 and ASTM C117, (AASHTO T11 and T27) and having a smooth curve without sharp breaks when plotted on a semi log grading chart to ASTM E11 70.

.1A 50 mm Minus Pitrun

Sieve Size	% Passing by Weight
50.0mm	100
40.0mm	90 to 100
25.0mm	63 to 93
12.5mm	38 to 73
5.0mm	22 to 50
2.5mm	13 to 40
0.40mm	5 to 22
0.08mm	2 to 10

.1B 80 mm Minus Pitrun

Sieve Size	% Passing by Weight
80.0mm	100
25.0mm	45 to 100
5.0mm	25 to 70
2.5mm	15 to 60
0.40mm	4 to 35
0.08mm	0 to 8

.1C 125 mm Minus Pitrun

Sieve Size	% Passing by Weight
125.0mm	100
50.0mm	55 to 95
25.0mm	38 to 80
5.0mm	25 to 70
0.40mm	8 to 35
0.08mm	2 to 12

.1D 200 mm Minus Pitrun

Sieve Size	% Passing by Weight
200.0mm	100
160.0mm	96 to 100
80.0mm	60 to 85
25.0mm	35 to 75
5.0mm	20 to 50
2.5mm	10 to 40
0.40mm	6 to 30

0.08mm	2 to 12

.2 Liquid Limit: ASTM D423 66 (AASHTO T89), Maximum 25
.3 Plasticity Index: ASTM D424 59 (AASHTO T90), Maximum 6
.4 Los Angeles Abrasion: ASTM C131 (AASHTO T96), Max % Loss by Weight 40.

3 Execution

3.1 INSPECTION OF EXISTING SUBGRADE SURFACE

.1 Do not place pitrun material until finished sub grade is inspected and approved.

3.2 PLACING

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow or ice.
.2 Begin spreading pitrun material on a crown line or high side of a one way slope.
.3 Place granular sub base materials using methods which do not lead to segregation or degradation.
.4 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
.5 Place material in uniform layers not exceeding 150 mm when compacted or to such other depth as approved.
.6 Shape each layer to a smooth contour and compact to a density of 100% Standard Proctor, at optimum moisture, before the succeeding layer is placed.
.7 Remove and replace portion of a layer in which material has become segregated during spreading.

3.3 COMPACTING

.1 Compact to a density of not less than 100% Standard Proctor.
.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.
.3 Apply water as necessary during compaction to obtain specified density. If sub base is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 FINISH TOLERANCES

.1 Finish compacted surface to within 13 mm of established grade but not uniformly high or low.
.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 PROOF ROLLING

.1 For proof rolling use a single axle dual wheeled truck loaded to a minimum 9100 kg on the rear axle. Tires to be inflated to a minimum 275 kPa.
.2 Engineer may authorize use of other acceptable proof rolling equipment.
.3 Proof roll at level directed by the Engineer.
.4 Where proof rolling reveals areas of defective subgrade:
  .1 Remove granular base and/or sub base and subgrade material to depth and extent directed.
  .2 Backfill excavated subgrade with approved common or borrow material and compact to specified requirements.
  .3 Replace pitrun material and compact.
.5 Where proof rolling reveals areas of defective subgrade or pitrun base or sub base, remove and replace to requirements of this section at no extra cost.

3.6 MAINTENANCE

.1 Maintain finished surface in condition conforming to this section until succeeding base is constructed, or until pitrun base is accepted by Engineer.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 This section specifies requirements for supplying, producing, placing and compacting crushed gravel or quarried stone as a granular base to lines, grades and typical cross sections indicated on plans or as directed.

2 Products

2.1 MATERIALS

.1 Granular base material to Section 02230 and following requirements:

.1 Gradation to be within the limits specified for the two (2) types of granular material specified hereinafter when tested to ASTM C136 and ASTM C117, (AASHTO T11 and T27) and having a smooth curve without sharp breaks when plotted on a semi log grading chart to ASTM E11-70.

.1A 20 mm Minus Gravel

Sieve Size	% Passing by Weight
20.0mm	100
12.5mm	60 to 95
5.0mm	35 to 65
2.00mm	25 to 55
0.400mm	10 to 30
0.080mm	2 to 10

.1B 50 mm Minus Gravel

Sieve Size	% Passing by Weight
50.0mm	100
40.0mm	85 to 100
20.0mm	60 to 95
5.0mm	25 to 60
2.0mm	15 to 45
0.400mm	5 to 25
0.080mm	2 to 8

.2 Liquid Limit: ASTM D423 (AASHTO T89), Maximum 25.

.3 Plasticity Index: ASTM D424 (AASHTO T90), Maximum 6.

.4 Los Angeles Abrasion: ASTM C131 (AASHTO T96), Max. % loss by weight: 45.

.5 Crushed Fragments: At least 60% of fragments within each of following size ranges to have at least 1 freshly fractured face:

Passing	Retained on	
50.0mm	to	38.0 mm
38.0mm	to	19.0 mm
19.0mm	to	5.0 mm

3 Execution

3.1 INSPECTION OF UNDERLYING SUB BASE OR SUB GRADE

.1 Do not place granular base until finished sub base or sub grade surface is inspected and approved.

3.2 PLACING

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.
.2 Begin spreading base material on a crown line or on high side of a one way slope.
.3 Place using methods which do not lead to segregation or degradation of aggregate.
.4 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
.5 Place material in uniform layers not exceeding 150 mm when compacted or to such other depth as approved by Engineer.
.6 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.
.7 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 COMPACTING

.1 Compact to a density not less than 100% of Standard Proctor.
.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.
.3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 FINISH TOLERANCES

.1 Finished base surface shall be within 13 mm of established grade but not uniformly high or low.
.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 PROOF ROLLING

.1 For proof rolling use a single axle dual wheeled truck loaded to a minimum 9100 kg. on the rear axle. Tires to be inflated to a minimum 275 kPa.
.2 Engineer may authorize use of other acceptable proof rolling equipment.
.3 Proof roll top of base upon completion of fine grading and compaction.
.4 Where proof rolling reveals areas of defective sub grade:
    .1 Remove base, sub base and sub grade material to depth and extent directed.
    .2 Backfill excavated sub grade with approved common or borrow material and compact to specified requirements.
    .3 Replace sub base material and compact to specified requirements.
    .4 Replace base material and compact to this section.
    .5 There shall be no payment for the repair of granular base caused by defective sub-grade.
.5 Where proof rolling reveals defective base or sub base, remove defective materials to depth and extent directed and replace with new materials to specifications at no extra cost to the Owner.

3.6 MAINTENANCE

.1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance by the Engineer.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies requirements for producing and placing hot mix asphaltic concrete for pavement base, surface or overlay including supply of aggregates and bituminous binder.

1.2 DEFINITIONS

.1 Overlay: paving over an existing pavement for rehabilitation purposes and not as part of a new pavement structure (pavement thickness varies).

.2 Paving: paving where a lift or lifts form part of the total pavement structure (pavement thickness is specified).

1.3 QUALITY ASSURANCE

.1 Source Sampling

.1 At least 2 weeks prior to commencing work inform the Engineer of proposed source of aggregates and provide access for sampling.

.2 Delivery and Storage

.1 Deliver and stockpile aggregates in accordance with Section 02230. Stockpile minimum 50 % of total amount of aggregate required before commencing asphalt production.

.2 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.

.3 When dryer drum mixing plant is used, stockpile fine aggregate separately from coarse aggregate.

.4 Provide approved storage, heating tanks and pumping facilities for asphalt cement.

.3 Quality Control Plan

.1 Before beginning hot mix asphalt production, submit quality control plan including the following recommended tests and frequency for each mix type produced to Engineer:

- Three Marshall specimens per test
- Asphalt content
- Air Voids
- Stability and flow
- Film thickness
- Moisture content in the mix
- Gradation in mix
- Plant discharge temperature
- Asphalt storage temperature
- Frequency: A minimum of 2 tests per day in full production (4 hours or more)

.4 Thickness Cores

.1 The quality assurance laboratory will take a minimum of one core per 1,000 m2 of asphalt pavement and determine the thickness of the entire mat.

.2 If the initial core thickness is deficient at the completion of paving, that initial thickness is discarded and 3 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average thickness of the 3 new cores will represent that area.

.3 Acceptance will be at full or reduced payment for actual thickness as shown in Table 02513.3.

.5 Density Specimen Sampling and Testing

.1 The quality assurance laboratory will determine the density of laboratory compacted Marshall Specimens at a minimum frequency of one Marshall Density for every 1,000 tonnes of hot mix, or day's production, whichever is less.

.2 Drill cores from a compacted mat placed from the same load of hot mix from which Marshall specimens were taken, or from suspect compacted mat, and test for density.

.3 A single core is initially taken representing the quantity of hot mix asphalt in not more than 1,000 m2 of mat, with a minimum of one taken from a day's production. If the initial core density is below specified, that initial density is discarded and 3 new cores will be taken within 10m of the original core location at a minimum spacing of 2.5 m between core holes. The average of the 3 new cores represents that area.

.4 Pavement compaction will be accepted on the basis of the ratio (in percent) of the core density to the density of the Marshall specimen. If cores were drilled from a mat where no Marshall specimen was taken, acceptance will be based on the ratio of the core density to the average of all Marshall specimens to date.

.5 Acceptance will be at full or reduced payment for actual density as shown in Table 02513.4.

2 Products

2.1 MATERIALS

.1 Asphalt cement: premium grade 80-100 (A) or 150-200 (A), to Table 02513.1, Chart's 02513.1A and 02513.1B.

Table 02513.1: Specifications for Premium Grade Asphalt Cements

TEST CHARACTERISTICS	A.S.T.M. TEST METHOD	PREMIUM GRADES OF ASPHALT CEMENTS					
		80-100 (A)			150-200 (A)		
Absolute Viscosity, 60°C, Pa – s	D2171	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by E-F-G-H-E plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Penetration, 25°C, 100g, 5s, dmm	D5	Pt.	Abs.Visc.	Pen.	Pt.	Abs.Visc.	Pen.
		A	450	80	E	155	150
		B	208	80	F	70	150
		C	150	100	G	50	200
		D	300	100	H	92	200
Kinematic Viscosity, 135°C, sq. mm/s	D2170	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by E-F-G-H-E plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Penetration, 25°C, 100g, 5s, dmm	D5	Pt.	Kin. Visc.	Pen.	Pt.	Kin. Visc.	Pen.
		A	600	80	E	360	150
		B	417	80	F	225	150
		C	350	100	G	205	200
		D	500	100	H	285	200
Flash Point, Cleveland Open Cup, °C minimum	D92	235			205		

TEST CHARACTERISTICS	A.S.T.M. TEST METHOD	PREMIUM GRADES OF ASPHALT CEMENTS	
		80-100 (A)	150-200 (A)
Solubility in Trichloroethylene, % minimum	D2042	99.5	99.5
Tests on Residue from Thin Film Oven Test: **Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:**	D1754 D2171	4.0	4.0
Ductility, 25°C, cm, maximum	D113	100	100
Ductility, 15.6°C, cm, minimum		-	-

General Requirement:
The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not be heated to 175 C. The temperature at delivery to the site shall be between 135 C and 175 C.

CHART 02513.1A : SPECIFICATIONS FOR ASPHALT CEMENT
ABSOLUTE VISCOSITY

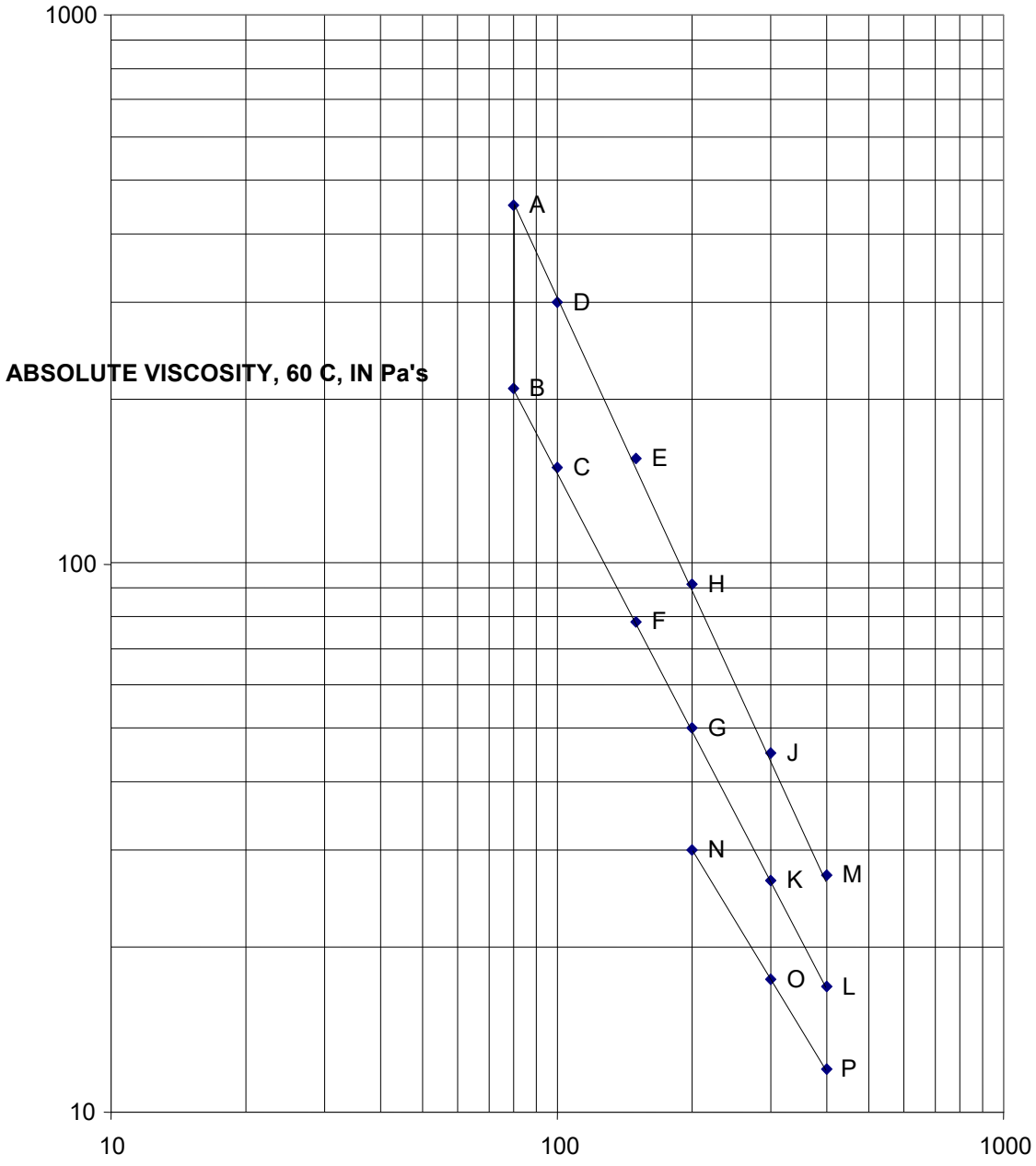
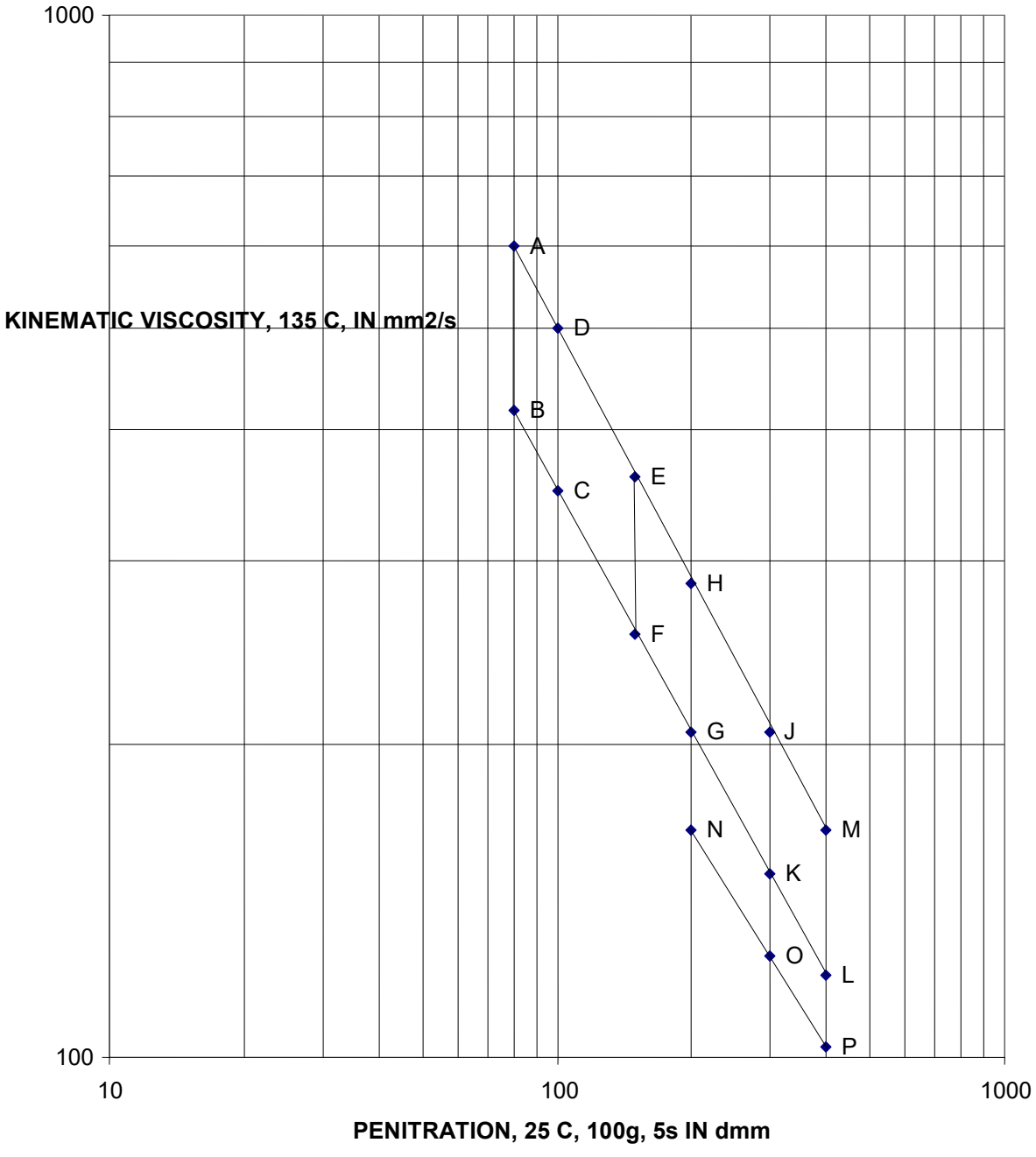


CHART 02513.1B : SPECIFICATIONS FOR ASPHALT CEMENT
KINEMATIC VISCOSITY



.2 Aggregates
- .1 To Section 02230 and as specified herein.
- .2 Coarse aggregate is aggregate retained on 5.0mm sieve and fine aggregate is aggregate passing the 5.0mm sieve.
- .3 Do not use aggregates having known polishing characteristics in mixes for surface courses.
- .4 Gradation of aggregates blended to job mix formula to be within the following limits when tested to ASTM C117 and ASTM C136 (AASHTO T27 and T11) and giving smooth curve without sharp breaks when plotted on semi-log grading chart:
- .5 Aggregates shall conform to the requirements in Table 02513.2

Table 02513.2: Aggregate Properties

Mix Designation	**Sand Course**	**Surface Course**	**Base Course**
Sieve Size	**4.75mm**	**12.5mm**	**25mm**
25 000	100		100
20 000			90 – 100
12 500		100	62 – 88
10 000		78 – 94	45 – 80
5 000	85 – 95	53 – 80	30 – 65
2 000	60 – 90		
1 250		32 – 54	12 – 38
630		24 – 44	8 – 30
400	25 – 75		
315		16 – 32	4 – 22
160		8 – 22	2 – 15
80	5 - 15	4 - 10	1 - 7

- .6 Sand equivalent to ASTM D2419 (AASHTO T176), Minimum 50, Sand Course 30
- .7 Magnesium Sulphate soundness to ASTM C88 (AASHTO T104) % loss by mass, coarse aggregate: 18, fine aggregate: 20
- .8 Los Angeles Abrasion to ASTM C131 (AASHTO T96) maximum % loss by mass, coarse aggregate: 40
- .9 Absorption to ASTM C127 (AAHSTO T85) maximum % by mass, coarse aggregate: 1.75
- .10 Loss by washing to ASTM C117 (AASHTO T11) maximum % passing 0.080mm sieve, coarse aggregate: 1.5
- .11 Lightweight particles to ASTM C123 (AASHTO T150) maximum % by mass less than 1.95 relative density: 1.5
- .12 Flat and elongated particles (with length to thickness ratio greater than 5), maximum % by mass, coarse aggregate: 15
- .13 Crushed fragments, minimum % by mass with minimum of 2 freshly fractured faces, coarse aggregate: 75% for 12.5mm surface course; 90% for 25mm base course

.3 Mineral Filler
- .1 Finely ground particles of limestone, hydrated lime, Portland Cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
- .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.
- .3 Mineral filler to be dry and free flowing when added to the aggregate.
- .4 Plasticity index of mineral filler to be zero.

2.2 MIX DESIGN

.1 Job mix design to be completed by an approved materials testing agency and submitted for approval to the Engineer at least two weeks prior to commencing paving operations.

.2 Design of mix by Marshall Method of Mix Design to the requirements below:

Mix Type	Sand Course	Surface Course	Base Course
Compaction blows on each face of test specimens		50	75
Minimum Marshall stability at 60 C, Kn	3.5	4.0	5.4
Flow value mm	5.0 maximum	2 - 4	2 - 4
Air voids in total mix, %	3 - 12	3 – 8	3 - 5
Voids in mineral aggregate, %	16	13	15

.3 Physical requirements to be measured as follows
- .1 Marshall Road and Flow Index to ASTM D1559.
- .2 Air Voids to ASTM D3203.
- .3 Voids in Mineral Aggregate to ASTM C127 and ASTM C128 with allowance for volume of asphalt absorbed in aggregate.

.4 Submit the following with the mix design
- .1 Temperature of asphalt during mixing in the plant.
- .2 Temperature of asphalt immediately prior to compaction.

.5 Do not change mix design without prior approval of the Engineer. Should a change in material source be proposed a new mix design must be approved by the Engineer.

3 Execution

3.1 PLANT AND MIXING REQUIREMENTS

.1 Batch and continuous mixing plants:
- .1 To ASTM D995.
- .2 Heat asphalt cement and aggregate to mixing temperature which will normally correspond to climatic viscosity of asphalt cement (ASTM 02170) in range of 150 to 300 centostokes or 175°C whichever is less. Do not heat asphalt cement above this temperature.
- .3 Before mixing, dry aggregates to a moisture content not greater than 0.5% by mass or to a lesser moisture content if required to meet mix design requirements.
- .4 Make available current asphalt cement viscosity data at plant.
- .5 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
- .6 Feed cold aggregates to plant in proportions that will ensure continuous operations.
- .7 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
- .8 Store hot screened aggregates in a manner to minimize segregation and temperature loss.
- .9 Maintain temperature of materials within ± 5°C of specified mix temperature during mixing.
- .10 Mixing time:
  - .1 In batch plants, continue wet mixing as long as necessary to obtain a thoroughly blended mix but not less than 30 s or more than 75 s.
  - .2 In continuous mixing plants not less than 45 s.

.2 Dryer drum mixing plant:
- .1 Feed aggregates to burner end of dryer drum by means of a multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
- .2 Meter total flow of aggregate by an electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt

pump so that proportions of aggregate and asphalt entering mixer remain constant.

.3 Provide for easy calibration of weighing systems for aggregates without having material enter mixer.

.4 Make provision for conveniently sampling the full flow of materials from the cold feed.

.5 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.

.6 Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.

.7 Accomplish heating and mixing of asphalt mix in an approved parallel flow dryer-mixer in which aggregate and asphalt enter drum at burner end and travel parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each week.

.8 Mixing period and temperature to produce a uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 2%.

.3 Temporary storage of hot mix:

.1 Provide mixture storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 3 H.

.4 While producing asphalt mix for this project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied for this project.

.5 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix (percent of total mass):

5.00 mm sieve and larger	±5.0
1.25 mm sieve	±4.0
0.63 mm sieve	±3.0
0.315 mm sieve	±3.0
0.160 mm sieve	±2.0
0.08 mm sieve	±1.0

.2 Permissible variation of asphalt cement from job mix, ±0.4%.

.3 Permissible variation of mix temperature at discharge from plant, 5 °C.

3.2 EQUIPMENT

.1 Pavers: mechanical self-powered pavers with automatic screed controls, vibratory screed equipped with vibratory extensions and augers capable of spreading mix within specified tolerances, true to line, grade and crown indicated without segregation and tearing.

.2 Rollers: sufficient number of self propelled rollers equipped with wetting and scraping devices to prevent adhesion of mix to drums or tires (petroleum derivatives not permitted for cleaning) of type and weight required to obtain specified density of compacted mix. Pneumatic-tired rollers are to be equipped with wind skirts.

.3 Haul trucks: of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Hand tools:
  .1 Lutes or rakes with covered teeth during spreading and finishing operations.
  .2 Tamping irons having mass not less than 12kg and a bearing area not exceeding 310 cm^5 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Engineer, may be used instead of tamping irons.
  .3 Straight edges, 3.0 m in length, to test finished surface.

3.3 PREPARATION

.1 Written notice of intention to begin paving operations to be given to Engineer 24h in advance.
.2 When paving over existing asphalt surface, clean pavement surface in accordance with Section 02565 – Pavement Surface Cleaning. When levelling course is not required, patch and correct depressions and other irregularities to approval of Engineer before beginning paving operations.
.3 Apply prime coat or tack coat where directed in accordance with Section 02571 - Liquid Asphalt Coats prior to paving.
.4 Prior to laying mix, clean surfaces of loose and foreign material.
.5 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

3.4 TRANSPORTATION OF MIX

.1 Transport mix to job site in vehicles cleaned of foreign material.
.2 Paint or spray truck beds with light oil, limewater, soap or detergent solution, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution or use of gasoline, kerosene, or similar product will be permitted.
.3 Schedule delivery of material for placing in daylight, unless Engineer approves artificial light.
.4 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.
.5 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at a temperature within range directed, but not less than 135°C.

3.5 PLACING

.1 Place asphaltic concrete to thicknesses, grades and lines indicated on drawings or directed by Engineer.
.2 Placing conditions:
  .1 No paving is permitted when rain or snow is imminent, or when the surface to be paved is wet, icy, snow-covered or frozen, unless waived by the Engineer.
  .2 No paving is permitted when air temperature and wind speed conditions are below the applicable mat curve in Chart 02513.2, unless waived by the Engineer.
  .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
.3 Place asphalt concrete in compacted lifts of thickness approved by Engineer.
.4 Spread and strike off mixture with self-propelled mechanical finisher.
  .1 Construct longitudinal joints and edges true to line markings. Lines for paver to follow parallel to centreline of proposed pavement. Position and operate paver to follow established line closely.
  .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30m apart.

.3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.4 Correct irregularities in alignment left by paver by trimming directly behind machine.

.5 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.

.6 Do not throw surplus material on freshly screeded surfaces.

.5 When hand spreading is used:

.1 Wood or steel forms, approved and rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross section.

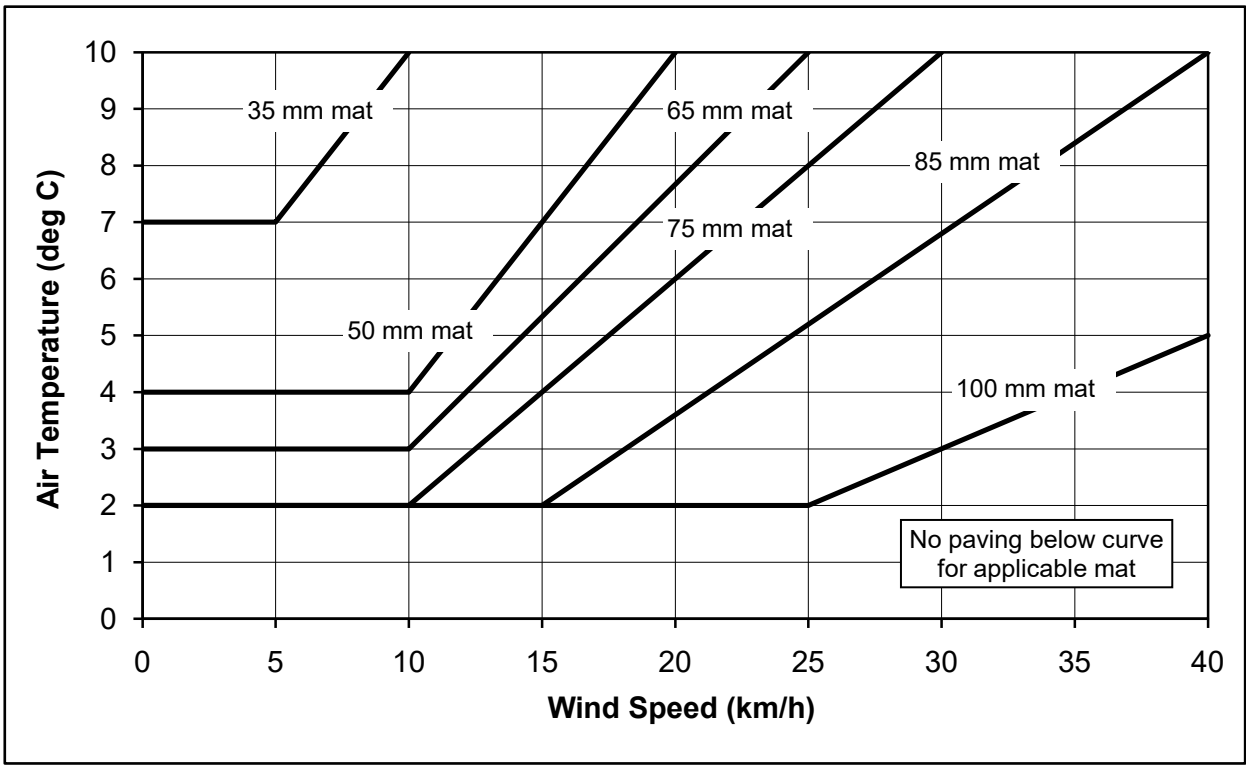
.2 Distribute material uniformly. Do not broadcast material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

.4 Following placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn material. Do not use tools at a greater temperature than temperature of mix being placed.

Chart 02513.2: Air Temperature and Wind Limitations on Paving



3.6 COMPACTING

.1 All asphalt mix shall be thoroughly compacted, and after final rolling the finished surface of the mix shall be free of segregation, waves, hairline cracks and other obvious defects.

.2 General:

.1 Provide at least two rollers one of which must be pneumatic-tired type, and as many additional rollers as necessary to achieve specified pavement density within the available compaction time and compatible with the rate of hot-mix placement.

.2 Start rolling operations as soon as placed mixture can bear weight of roller without undue displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. For subsequent rolling do not exceed 5 km/h for steel-wheeled rollers and 8 km/h for pneumatic-tired rollers.

.4 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.6 Complete final rolling before the mat temperature reaches 80º C.

.7 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.8 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.9 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

3.7 JOINTS

.1 General:

.1 Trim to vertical face to provide true surface and cross section against which new pavement may be laid. Remove loose particles.

.2 Paint joint face with thin coat of hot asphalt cement prior to placing of fresh mixture.

.3 Overlap previously laid strip with spreader by 100 mm.

.4 Remove surplus material from surface of previously laid strip. Do not dispose on surface of freshly laid strip.

.2 Transverse Joints:

.1 Construct and thoroughly compact transverse joints to provide a smooth riding surface.

.2 Stagger joint locations minimum 2 m.

.3 Offset transverse joint in succeeding lifts by at least 600 mm.

.3 Longitudinal Joints:

.1 Plan mats so that the surface longitudinal joint will be offset by not more than 150 mm from the centre of an indicated marking line between travel lanes. If permitted by the Engineer, the joint may be located at the centre of travel lane.

.2 Plan width of spread to provide for a minimum 150 mm offset of longitudinal joints in successive lifts.

.3 Create a longitudinal joint while the edge temperature of the first of two adjacent mats is above 80º C. This may be accomplished by multiple pavers in staggered formation, or by limiting paver advance.

.4 Allow a 25 mm to 50 mm overlap between mats.

.5 Do not roll a 150 mm wide strip along the edge of first mat until the adjoining mat is placed. Roll the joined mat immediately to insure bonding while the joint temperature is above 80º C.

.6 For surface lifts on freeways, arterial roadways, industrial/commercial roadways and collector roadways carefully roll off the edge of a mat if a minimum joint temperature of 80º C cannot be maintained prior to the placement of the adjacent mat. Trim off the rolled asphalt to a width of 150 mm resulting in a clean vertical face to the full depth of the mat. Paint the exposed face with tack coat to Section 02571 - Liquid Asphalt Coats prior to placing the adjacent mat.

.7 Should this longitudinal joint treatment not be performed where required, the area of asphalt pavement will be assessed a pay factor of 95%. This pay factor will be applied to the price of the total quantity of asphalt placed in the mat area.

.8 A longitudinal joint shall be thoroughly compacted and shall meet surface tolerances.

.4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade.

3.8 FINISH TOLERANCES

.1 Finished asphalt surface to be within ±5mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5mm when checked with a 3.0 m straight edge placed in any direction.

.3 The finished surface shall have a tightly knit texture free of visible signs of poor workmanship including, but not limited to, segregation, areas exhibiting excess or insufficient asphalt, improper matching of longitudinal and transverse joints, roller marks, cracking or tearing.

3.9 ASPHALT CONCRETE THICKNESS TOLERANCES

.1 All asphaltic concrete pavement to be of thickness indicated on drawings.

.2 If the average core thickness is deficient that area of asphalt pavement will be assessed a pay factor according to Table 02513.3 to be applied to the price of the quantity of hot-mix in that mat area placed.

Table 02513.3: Asphalt Thickness Pay Factors

Thickness Deficiency (mm)	Pay Factor (%)
6.0	100.0
7.0	97.0
8.0	93.7
9.0	90.0
10.0	85.5
11.0	80.5
12.0	75.0
13.0	68.0
14.0	60.0
15.0	50.0
Over 15.0	Grind and resurface

.3 Asphalt pavement with excess thickness may be accepted with no claim for extra payment, if surface, grade tolerances and texture are met.

3.10 ASPHALT DENSITY TOLERANCES

.1 Each mat of hot-mix asphalt placed shall be compacted to the following minimum density (% of Marshall Density) for the type of paving, or as indicated in the contract special provisions.

Minimum Density	Type of Paving
98%	All paving for freeways, arterials, industrial/commercial roadways and residential collector roadways.
96%	Paving local residential roadways.
97%	Alley paving.
97%	Rehabilitation overlay mat >40 mm thick.
96%	Rehabilitation overlay mat □40 mm thick; asphalt walk/bikeway.

.2 If the average core density is below the specified density the area represented by the mat in question may be accepted subject to a pay factor according to Table 02513.4 to be applied to the price of the quantity of hot-mix asphalt in that mat area.

Table 02513.4: Asphalt Density Pay Factors

98% Required		97% Required		96% Required	
Actual Density (%)	**Pay Factor (%)**	**Actual Density (%)**	**Pay Factor (%)**	**Actual Density (%)**	**Pay Factor (%)**
98.0	100.0	97.0	100.0	96.0	100.0
97.9	99.9	96.9	99.9	95.9	99.7
97.8	99.8	96.8	99.7	95.8	99.3
97.7	99.6	96.7	99.4	95.7	98.9
97.6	99.4	96.6	99.1	95.6	98.4
97.5	99.1	96.5	98.7	95.5	97.8
97.4	98.7	96.4	98.2	95.4	97.1
97.3	98.3	96.3	97.7	95.3	96.4
97.2	97.8	96.2	97.1	95.2	95.6
97.1	97.2	96.1	96.3	95.1	94.6
97.0	96.5	96.0	95.5	95.0	93.4
96.9	95.8	95.9	94.6	94.9	92.2
96.8	95.0	95.8	93.6	94.8	90.7
96.7	94.2	95.7	92.5	94.7	89.1
96.6	93.3	95.6	91.3	94.6	87.3
96.5	92.3	95.5	89.9	94.5	85.1
96.4	91.1	95.4	88.4	94.4	82.6
96.3	89.8	95.3	86.7	94.3	79.5
96.2	88.5	95.2	84.8	94.2	75.5
96.1	87.1	95.1	82.7	94.1	69.7
96.0	85.5	95.0	80.3	94.0	60.0
95.9	83.8	94.9	77.6		
95.8	82.0	94.8	74.3	Under 94.0	**Reject**
95.7	80.0	94.7	70.6		
95.6	77.7	94.6	66.0		
95.5	75.4	94.5	60.0		

98% Required		97% Required		96% Required	
Actual Density (%)	**Pay Factor (%)**	**Actual Density (%)**	**Pay Factor (%)**	**Actual Density (%)**	**Pay Factor (%)**
95.4	73.0				
95.3	70.3	Under 94.5	**Reject**		
95.2	67.2				
95.1	63.7				
95.0	60.0				
Under 95.0	**Reject**				

Actual Density = % of Marshall Density
Pay Factor = % of contract price

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies requirements for constructing Portland Cement concrete curbs, curbs and gutters, sidewalks, medians and driveways.

2 Products

2.1 MATERIAL

.1 Concrete: Section 03 00 00
.2 Reinforcing Steel: Section 03 20 00 if required
.3 Welded Wire Mesh: Section 03 20 00 if required.
.4 Joint filler: to ASTM D1751 (AASHTO M213) 20 mm preformed, non-extruding, resilient, bituminous type or approved alternates.
.5 Curing compound to ASTM C309 with fugitive dye or plastic film to ASTM C171. Curing compound not to be applied where frost is expected within 14 days.
.6 Sealing solution: White pigmented sealer or other sealant approved by the Engineer.
.7 Form release agent: non-staining mineral type.

3 Execution

3.1 GRADE PREPARATION

.1 Concrete curbs, curbs and gutters, driveways and swales: Section 34 71 01
.2 Concrete sidewalk and medians: to Section 34 71 01 with sub-grade compacted per geotechnical recommendations.

3.2 GRANULAR BASE

.1 Sidewalks, medians: 150 mm granular base compacted to a density of 100% of Standard Proctor.
.2 Concrete driveways and swales: 150 mm granular base compacted to a density of 100% of Standard Proctor.
.3 Concrete slab median: not applicable.

3.3 TIE TO EXISTING CONCRETE

.1 Remove existing concrete back to an existing joint or sawcut a straight edge to tie to.
.2 In curb and gutter sections drill two 10 mm diameter holes a minimum of 150 mm into the existing section at each end. One hole to be located at the midpoint of the gutter pan and the second hole in the midpoint of the curb section. When connecting sidewalk or slabs to curbs drill 10 mm diameter holes 100 mm deep at a spacing of 600 mm maximum.
.3 For flatwork drill 10 mm diameter holes 150 mm deep at a spacing of 600 mm maximum or a minimum of 3 holes per connection whichever is greater.
.4 Butter drilled holes with concrete mortar.
.5 Drive home 450 mm long 10 M rebar into each hole. Bars to extend at least 300 mm into new poured section.

3.4 FORMING

.1 Forms
  .1 Form vertical surfaces to full depth using forming material that will not deform under loading by plastic concrete.
  .2 Securely position forms to required lines and grades.
  .3 Coat forms with non-staining mineral type Form release agent.
  .4 Obtain approval of forms before placing concrete.

3.5 REINFORCING STEEL

.1 Place steel to details indicated and to Section 03 20 00.
.2 Make laps of 500 mm where continuous reinforcement is required.
.3 Make laps of 300 mm width, where required for wire mesh.

3.6 CONCRETE

.1 Do concrete to Section 03305 and as specified herein.
.2 Finish exposed surfaces to a smooth uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to surface than required. Do not use neat cement as a drier to facilitate finishing.
.3 Broom finish surface to provide non-skid texture.
.4 Round edges, including edges of joints, with 5 mm radius edging tool.
.5 Finish surfaces to within 6 mm in 3 m from line, level or grade as measured with a straight edge placed on surface.
.6 Cure concrete to CAN3-A23.1 Section 21.1
.7 Seal all concrete as follows:
    .1 Apply with spray method only, one coat of evenly applied white pigmented sealer.
    .2 Insure concrete surfaces are dry, free of dirt or dust, and at least one week old before applying coating.
    .3 Apply according to manufacturer's specification.
    .4 Protect adjacent surfaces from spray.

3.7 EXPANSION AND CONTRACTION JOINTS

.1 For all flatwork (sidewalks, medians and driveways) install contraction joints a minimum of 1/4 of the depth of slab and 6 mm wide at intervals of 1.5 m.
.2 For all flatwork (sidewalks, medians, and driveways) wider than 2.0 m a longitudinal contraction joint shall be included by either sawcutting or finishing. The contraction joint shall be a minimum of 1/4 of the depth of slab located at the midpoint of the slab or at a maximum 2 metre spacing. If the contraction joint is to be a sawcut it shall be completed within 24 hours of concrete placement.
.3 For curb and gutter install contraction joints a minimum of 40 mm deep and 6 mm wide at intervals of 3.0 m. On 500 mm gutter sections the back section of the gutter is to be deep cut with a trowel at each contraction joint.
.4 When sidewalk is adjacent to curb, make joints coincide.
.5 Install isolation joints in concrete around manholes, poles, hydrants etc. and along length of concrete adjacent to concrete curb, building, or permanent structure.
.6 Install construction joints at the end of all reinforced sections.

3.8 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.
.2 Backfill to designated elevations with suitable material, compact to 95% of Standard Proctor and shape to required contours as indicated or directed by the Engineer.
.3 Backfill within 500 mm of concrete is incidental to work done under this section. Any additional work required beyond this 500 mm limit shall be paid for under the appropriate classification as specified in Section 02225 Roadway Excavation, Backfill and Compaction.

3.9 REJECTION OF CONCRETE

.1 Concrete work shall be subject to rejection at the Engineer's discretion for any of the following reasons:
    .1 Misalignment of vertical or horizontal grade
    .2 Gutters or swales which pond water

.3 Cracks in locations other than at joints
.4 Flaking or spalling of the surface
.5 Vertical displacements between adjoining sections or other forms of settlement
.6 Surfaces which are marked or damaged
.7 Failure to meet strength requirements as detailed in Section 03305
.8 Variance from design section as specified on the drawings
.9 Improper ties to existing concrete.
.10 Non-conformance to any requirement of the specifications or drawings.

END OF SECTION

DIVISION 40

PROCESS INTERCONNECTIONS

1 General

1.1 INTENT

.1 This specification includes general requirements applicable to the supply, installation and testing of the complete process systems.

1.2 CONDITIONS AND DEFINITIONS

.1 The term “process” refers to all equipment and system which are used for the treatment and supply potable water. This also incorporates residuals handling and management system.

.2 The term “chemicals” refers to chemicals that are used as part of the treatment process.

.3 The terms Manufacturer and Supplier are interchangeable and have the same meaning with respect to the interpretation of this Section.

1.3 REGULATORY REQUIREMENTS

.1 Contractor is responsible to comply with all the latest versions of Regulatory Requirements and Codes whether specifically mentioned in the Contract Documents or not.

1.4 SUBMITTALS

.1 Provide
  .1 Current ANSI / NSF 60 & 61 certification.

.2 Contractor to submit individual submittals for each product or piece of equipment.

.3 “Bulk” submittals will be returned, “Not Reviewed”.

.4 Refer to individual process specifications for additional submittal requirements.

1.5 CONTRACTOR RESPONSIBILITIES

.1 The Contractor shall provide all tools, equipment, materials, and supplies necessary and shall provide all labor necessary to complete the Work specified herein and within the Contract Document to provide a complete and functional system.

.2 Refer to and comply with Sections 01 70 00 Execution and Closeout Requirements and 01 79 00 Demonstration and Training.

1.6 EXAMINATION OF DRAWINGS

.1 The Contractor shall review the Contract Documents and obtain additional dimensions and details from the Place of Work. Accurate dimensions shall be verified by actual measurements by the Contractor.

.2 Should the Contractor wish to change the location of equipment or pipework, they shall submit a request to the Owner’s Representative. If accepted, such changes shall be made at no additional cost to the Owner or the Owner’s Representative.

.3 No additional costs will be permitted for any additional labor or materials required for relocation of equipment due to interference with equipment of other trades, beams, joists, walls, etc., unless the conflict has been submitted and identified to the Owner's Representative in writing before closing of tenders.

1.7 NOTICES, PERMITS, AND CERTIFICATES

.1 Contractor is responsible to obtain all necessary permits for this portion of the work.

.2 Refer to Front end documents for additional information.

2 Products

2.1 IDENTIFICATION

.1 Manufacturer's nameplates:
- .1 Provide corrosion resistant metal nameplate on all equipment. Mechanically fastened with raised or recessed letters.
- .2 Provide Underwriters' Laboratories or CSA registration plates, as required by respective agency.
- .3 Manufacturer's nameplate to indicate size / capacity, equipment model, manufacturer's name, serial number, voltage, cycles, phase, power of motors, and any other relevant parameters for equipment identification.
- .4 Locate nameplates so that they are easily read. Do not paint over nameplates.

.2 Component Nameplates:
- .1 Provide laminated plastic plates with black face and white center of minimum size 90 x 40 x 2.5 mm nominal thickness, engraved with 6 mm high lettering. Use 25 mm lettering for major equipment.
- .2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.
- .3 Identify equipment type, number and service (e.g. Distribution Pump No. 2).
- .4 Submit list of nameplates for review prior to engraving.

.3 Valve Identification
- .1 Refer to Section 40 05 51 Common Requirements for Process Valves

2.2 NUTS, BOLTS AND GASKETS

.1 Refer to specific piping specifications.

.2 Unless noted otherwise all nuts, bolts anchors or fasteners shall be type 304 stainless steel.

.3 Nuts with integral washers are NOT ACCEPTABLE.

.4 For gaskets refer to 40 05 06 Couplings, Adapters, and Specials for Process Piping.

2.3 PIPE SIZE CONVERSION

.1 The following conversions are applicable within the Contract Documents
- .1 3 mm (1/8 in)
- .2 6 mm (1/4 in)
- .3 10 mm (3/8 in)

.4 13 mm (1/2 in)
.5 20 mm (3/4 in)
.6 22 mm (7/8 in)
.7 25 mm (1 in)
.8 32 mm (1.25 in)
.9 40 mm (1.5 in)
.10 50 mm (2 in)
.11 65 mm (2.5 in)
.12 75 mm (3 in)
.13 100 mm (4 in)
.14 125 mm (5 in)
.15 150 mm (6 in)
.16 200 mm (8 in)
.17 250 mm (10 in)
.18 300 mm (12 in)
.19 350 mm (14 in)
.20 400 mm (16 in)
.21 450 mm (18 in)
.22 500 mm (20 in)

2.4 COMPATIBILITY

.1 All substances, materials or components that are in contact with chemicals shall be suitable for handling the specified chemical service.

.2 If any of the specified substances, materials or components are incompatible or not recommended for use with the specified chemical service, the Contractor shall inform the Owner's Representative and recommend alternatives.

2.5 ANSI/NSF 60 & 61 REQUIREMENTS

.1 In-direct Additives (i.e. all substances, materials or compounds that may come in contact with water in the waterworks being treated to be potable) refer to and comply with the Alberta Environment and Parks' Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.
  .1 The product should be NSF 61 certified.
  .2 In absence of a product that is certified, all wetted materials must be NSF 61 certified. In addition, consideration should be made to the underlying materials, lubricants and all other parts of the product to ensure that they will not degrade the water quality should they come in contact in the event of a malfunction, such as coating failure. Examples include lead-free brass and food grade lubricants.

.2 Directive Additives (i.e. all substances, materials or compounds that are added to water in the waterworks being treated to be potable) refer to and comply with the Alberta Environment and Parks' Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.

.3 Refer to the requirements of this Section for submittal requirements with regards to NSF 60 and NSF 61 certification.

2.6 PRODUCT REQUIREMENTS

.1 Refer to and comply with individual technical specifications.

2.7 PRODUCTS USED IN DESIGN

.1 Refer to the individual valve specifications.

2.8 MANUFACTURERS

.1 Acceptable Manufacturers are selected based upon the following criteria
  .1 Performance / compatibility of supplied equipment
  .2 Historical level of service provided by the manufacturer
  .3 Historical level of service provided by the local distributors / representatives
  .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Request for Alternate or Substitute Products or Equipment
  .1 The products listed in the individual sections are to be used as a guide and do not imply exclusion of unlisted manufacturers and models.
  .2 The Contractor to submit written request complete with all submittal information on the requested alternate product or equipment.
  .3 Requested alternates or substitutions will be assessed based on the owner requirements and against the product/equipment used as the basis of design. Just because there is a request does not guarantee that the request will be accepted.

2.9 HYDROSTATIC TESTING

.1 Supply all potable water, temporary pipework, fixings and fittings to complete hydrostatic testing.

.2 Dispose of water used during the test in a responsible manner as to not damage the surrounding area, environment, infrastructure or Work.

.3 For pressure testing requirements of process tanks, process piping, chemical systems, etc. refer to individual technical specifications.

3 Execution

3.1 DEMOLITION

.1 Coring, cutting and patching shall not damage any existing system that is to remain in service. If such damage occurs the Contractor is to remove and replace with new products of equal capacity and quality.

.2 All unused waste, water and vent piping that is no longer in service shall be removed from ceilings, walls and floors. No dead piping will be allowed to stay. Underground piping shall also be removed.

.3 If piping cannot be removed underground it shall be capped, and the Owners Representative shall be notified.

.4 If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 INSTALLATION

.1 The Contractor will supply all necessary parts, labour and tools for complete installation of the Work.

.2 The Contractor shall ensure that competent personnel installs all process equipment in strict accordance with the manufacturer's instructions and rules, regulations and orders of Federal, Provincial and Municipal government agencies, applicable to the Work under the Contract.

.3 The Contractor shall install all products in accordance with the most stringent requirements, whenever a requirement conflict occurs.

.4 Products installed shall be new and of uniform construction.

.5 Equipment shall be installed and tested in strict accordance with manufacturer's recommendations and governing rules, regulations, and codes.

.6 Erect equipment on foundations complete with anchor bolts, suitably sized by the Contractor and verified by the Manufacturer.

.7 Special care to be taken to ensure true alignment of parts, especially pumps and electrical drives. Align the units after their sole plates have been shimmed at the anchor bolts. Recheck alignment after securing equipment to its foundation before grouting sole plates in place.

.8 Recheck alignment of equipment handling hot fluids, during initial operation.

.9 Maximum headroom, minimum interference with free use of surrounding areas, and access to equipment, shall be the governing requirements applied to all work. Where the Contractor identifies conflicts that do not meet these requirements, the Contractor shall inform the Owner's Representative in writing in a timely manner.

.10 Piping and Fittings
- .1 Refer to Section 40 05 06 – Couplings, Adapters and Specials for Process Piping.
- .2 Refer to Section 40 05 23 – Stainless Steel Process Pipe and Tubing.
- .3 Refer to Section 40 05 31.13 – Polyvinyl Chloride (PVC) Process Pipework

.11 Piping and equipment shall be installed square and parallel to building lines unless otherwise noted.

.12 Piping to be adequately supported. Refer to Section 40 05 07 Hangers and supports for Process Piping

.13 Measuring Devices
- .1 Install measuring devices supplied under the Contract Documents.
- .2 Provide all pipes and fittings required for complete installation of measuring devices including reducers, weldolets, shut off valves, flushing connections, drains, bolts, nuts, washers and gaskets, etc.
- .3 Provide and install weldolets for pressure sensors and pressure switch sensors on metal piping systems.
  - .1 Back weld weldolets installed on steel or stainless-steel pipes.
- .4 Use tapped saddles for pressure sensors and pressure switch sensors on plastic piping systems.

.5 Pipe couplings, tapped saddles, valves, flexible connectors and fittings shall
  .1 Be of materials similar to that of the piping to which they are connected, and
  .2 Have pressure and temperature ratings equivalent to that of the piping to which they are connected.
.6 Orient isolating valves and all indicators in accordance with the following:
  .1 Minimal interference with structures and with any other equipment or piping.
  .2 Show valve position indicator from a point no less than 2.5 m away and from an individual's position, compatible with normal plant operation.
  .3 Allow for ease of maintenance and disassembly.
  .4 Re orient as required to satisfy the above conditions or any other special condition specified elsewhere in the Contract Documents.

3.3 PRESSURE TESTING

.1 Prior to the commencement of any testing of the system using water, complete pressure testing of equipment and pipework.

.2 Supply all potable water, air and insert gases required for pressure testing

.3 Supply of pumps, compressors, gauges etc. required for pressure testing

.4 Install threadolets, air relief valves, and line fitting valves necessary to complete pressure testing. All equipment will be removed after testing and threadolets plugged.

.5 Cap and plug all lines which are normally open-ended and remove on completion of a successful pressure test.

.6 Isolate and protect all low pressure equipment and appurtenances during pressure testing so as not damage any equipment.

.7 Where hydrostatic testing is completed with water, ensure all lines / equipment are filled with water. Bleed air from all high spots.

.8 Where defective material of equipment is identified, repair or replace using new material and re-test.

.9 Dispose of water used during the test in a responsible manner as to not damage the surround area, environment, infrastructure, or Work.

.10 For pressure testing requirements of pipework, fittings and equipment refer to individual technical specifications.

3.4 CLEANING, FLUSHING, AND DISINFECTION

.1 All pipes must be cleaned, flushed, and for potable water piping properly disinfected prior to being put into service.

3.5 TESTING AND VERIFICATION

.1 Refer to and comply with Sections 01 70 00 and 01 79 00.

.2 Refer to and comply with individual technical specifications.

3.6 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23.

.2 Refer to and comply with individual technical specifications.

3.7 SPARE PARTS

.1 Refer to and comply with individual technical specifications.

3.8 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials identification and installation for all piping, fitting, valves, piping specialties and support devices.

1.2 CONDITIONS AND DEFINITIONS

.1 None.

1.3 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 – Submittal Procedures.

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Refer to and comply with Section 01 60 00 - Product Requirements.

2 Products

2.1 PRODUCT REQUIREMENTS

.1 Pipe Expansion:
- .1 Install piping to permit free movement of piping caused by thermal expansion and contraction except where it is anchored.
- .2 Provide for expansion and contraction by installing suitable expansion pieces of flexible connectors where indicated in the Drawings and as is necessary if not shown on the drawings.
- .3 Design expansion pieces or flexible connectors for the lengths of straight runs shown and the highest expected temperature differentials unless specified otherwise.
- .4 All used expansion pieces and flexible connectors shall have similar ratings to the test pressures specified for the particular piping to which they are installed.
- .5 Construct expansion pieces to limit turbulence and pressure drop. Where necessary, provide liners of materials compatible with the process fluid to prevent erosion and corrosion. In any case, provide liners for services when the process fluid is dirty or contains solids.
- .6 Provide anchors, supports and guides where necessary to limit movements to those directions and magnitudes permitted for the specific joint or flexible connector. Anchors, supports and guides shall direct expansion towards expansion pieces or flexible connectors.
- .7 Install expansion pieces and flexible connectors in accordance with the standards of the Expansion Joint Manufacturers Association, Inc.

.2 Corrosion Protection for Buried Piping:
- .1 All buried ferrous metal piping shall be protected against corrosion with external protective covering. Coverings shall be continuous over the pipe joints.
- .2 Acceptable products are yellow jacket by Shaw Pipe Protection, Denso tape, Polyken Wrap, or approved equivalent.
- .3 Provide a magnesium anode on each section of buried ferrous piping.

.3 Control and Instrumentation Piping:

.1 Supply and install pressure sensing and control lines, together with valves, fittings, and appurtenances for the control of gauges, pressure switches, pressure reducing valves and various instrumentation devices all as shown on the drawings or as specified in contract documents.

.4 Unions and Couplings:
- .1 Size 50 mm and under: 1035 kPa ground joint unions for threaded piping. See individual pipe specifications for details.
- .2 Sizes 60 mm and over: 1035 kPa forged slip on or weld neck flanges for metal piping. See individual pipe specifications for details.
- .3 For grooved mechanical couplings see individual piping specifications for details.
- .4 For underground couplings use a self restraining type coupling. See underground piping specifications. All underground couplings shall be wrapped in a Denso tape. Fasteners shall have an anti-corrosion coating or be type 316 stainless steel.

.5 Flange Gaskets:
- .1 Refer to specific piping specifications.
- .2 Unless noted otherwise use the following:
  - .1 25 mm diameter through 450 mm diameter - 1/8" thick gasket: Red rubber, ring type for raised face (RF) flanges, full face (FF) for FF flanges.
  - .2 500 mm diameter and larger - ¼" thick gasket: Red rubber, ring type for RF flanges, full face for FF flanges.

.6 Isolation ring
- .1 Commodity – Wastewater
- .2 Operating Pressure Range – 0 to 150 PSI
- .3 Operating Temperature Range – 0 to 25°C
- .4 Connection – Wafer style to fit ASME B16.5 150 class flange
- .5 Fill – Glycerin
- .6 Instrument connection
  - .1 ½” NPT
  - .2 Quick release
- .7 End plate and Body – 316 Stainless Steel
- .8 Flexible liner – Buna-N

.7 Pressure Indicating Transmitter:
- .1 Commodity – connected to isolation ring (Wastewater)
- .2 Operating Pressure Range:
  - .1 Gauge pressure: 0 to 150 PSI
- .3 Operating Temperature Range – 0 to 25°C
- .4 Pressure Transmitter Requirements.
  - .1 Designed to ASME B40.100
  - .2 4-20mA.
  - .3 Accuracy +/- 0.5% span.
  - .4 Process connection ½” NPT, Lower mount.
  - .5 316L stainless steel.
  - .6 Stainless steel movement.
  - .7 Dual range psi and kPa.
  - .8 NEMA Type 6P Enclosure
  - .9 Die-cast aluminium.
  - .10 Powder Coated.
  - .11 ½” NPT cable entry.

.12 Display on the device.
.13 Certificate and Approvals – CE mark, CRN, CSA.
.5 To be mounted on the Isolation Ring.

.8 Pipe Annular Space Sealing
.1 When piping passes through a sleeve or cored hole in walls or floors and the annular space needs to be have a watertight seal the use of a modular seal will be used.
.2 The modular seal shall be compatible with the commodity that it is holding back.
.3 The fasteners of the modular seal must be type 316 stainless steel unless this is incompatible with the commodity that is being held back then the contractor will inform the Owner's Representative and suggest an alternative.

.9 Alignment and Grade of Piping:
.1 Establish the pipe location and grade in accordance with the drawings.
.2 Install piping parallel to building walls and ceilings.
.3 Determine exact location of each pipe in the field with respect to adjacent and interconnecting piping and equipment.

2.2 PRODUCTS USED IN DESIGN

.1 The Contract Documents are based upon the application of a:
.1 Isolation Ring
.1 Ashcroft Type 80
.2 Pressure Indicating Transmitter
.1 Endress Hauser – PMC71
.3 Pipe modular seals.
.1 PSI / Linkseal

.2 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
.1 Ensure that the performance and functionality of the specified system is maintained, and
.2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.3 MANUFACTURERS

.1 Acceptable Manufacturers
.1 The following manufactures have been identified as potential suppliers of the required items / equipment.
.1 Isolation Ring
.1 Ashcroft
.2 Pressure Indicating Transmitter
.1 Endress Hauser
.3 Pipe modular seals
.1 Link-Seal
.2 Acceptable Manufacturers are selected based upon the following criteria
.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Alternate or Substitute Products
.1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Section 01 70 00 – Execution and Closeout Requirements.

3.2 INSTALLATION

.1 Installation of Piping – General:
.1 Labour in these specifications shall be performed by holders of current certificates of proficiency issued pursuant to the Trademan's Qualification Act.
.2 Welding shall conform to qualified procedures which satisfy the ASME Boiler and Pressure Vessels Code, ANSI Code for Power Piping and all Provincial and local codes having authority.
.3 Welding shall be performed only by holders of a valid Class B, Pressure Welders Certificate issued by the Government of the Provincial Department of Labour.
.4 Pipes shall be adequately supported on concrete pedestal stanchions or from galvanized or stainless steel pipe hangers/supports as per Section 40 05 07 Hangers and Supports for Process Piping.
.5 The Owner’s Representative reserves the right, if he deems it desirable, to have flanged joints unbolted at the equipment flanges to determine if there is any misalignment.
.6 Flanged joints shall be made up square with even pressure upon the gaskets and shall be watertight.
.7 After fabrication of piping, ensure that piping is internally cleaned.
.8 Rack and group pipe and conduit runs to achieve a neat and orderly installation.
.9 Permit equipment maintenance and disassembly by use of approved couplings, unions or flanges to minimize disturbance to connecting piping and without interference from building structure or other equipment.

.2 Flanges Bolting to Valves:
.1 Do not weld adjacent flanges on butterfly valves when the valves are in place.
.2 If these valves are bolted in place for alignment purposes, the flanges may be tack welded, but particular care shall be taken not to overheat and damage the rubber seating on the valves. The valves must be removed prior to the completion of the welding.
.3 All gasket surfaces, flange faces and butt welding connection of valves shall be thoroughly cleaned, greased and protected with suitable wood, metal or other substantial type covering to ensure their full protection.

.3 Bolted Connection:
.1 Before installing bolted connections, pipe ends and gaskets shall be absolutely clean.
.2 Gaskets shall be lubricated with soapy water and bolts with thread lubricant.
.3 Bolts shall be tightened progressively by the crossover method and not in rotation around the joint. Bolts shall be torqued to the manufacturer's requirements. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of nut and bolt heads.

.4 Screwed Joints:

.1 Screwed joints shall be made up with thread compound suitable for the piping material and fluid conveyed.
.2 Compound shall be applied to the male thread only.
.3 Threads shall be clean, machine cut, and all pipe ends shall be reamed after cutting to remove any burrs.
.4 Before erection, each length of pipe shall be upended and rapped to dislodge dirt and scale.
.5 Pipelines shall be installed with as few joints as possible.
.6 Short lengths of pipe coupled together shall not be used.
.7 If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied.
.8 Threads shall not be caulked.
.9 In general, reducing fittings shall be used for changes in pipe sizes.
.10 Bushing shall not be used.
.11 Nipples in screwed piping shall be shoulder nipples.
.12 Close nipples shall not be used unless specifically indicated.
.13 All exposed male threaded parts shall be greased and protected with metallic or other substantial type protectors.
.14 All exposed female threaded openings shall be cleaned and closed with pipe plugs or steel or plastic snap-in protectors.

.5 Dielectric Couplings:
.1 Provide wherever pipes of dissimilar metals are jointed.
.2 Provide insulating unions for pipe sizes NPS 50mm (2 inch) and under and flanges for pipe sizes over 50 mm (2 inch) NPS.
.3 Provide felt or rubber gaskets.

.6 Piping Built into Walls, Floors, Etc.:
.1 Piping to be built into walls, floors, etc., shall be located to position the bolting holes in flanged piping to the correct orientation to receive valve and other fittings mating to them.
.2 Piping to be built into mass concrete or reinforced concrete walls, floors, etc., shall be cast in at the time of concreting the wall, floor, etc., and box outs will not be permitted.
.3 Remove the coating from metallic pipes, including sleeves and spools, to be cast in concrete, to permit a good bond.
.4 Set sleeves and spools accurately before concrete is placed or masonry built.
.5 Where indicated on drawings, provide water tight mechanical seal system where pipes pass through floors and walls.
.1 For locations of penetrations to be determined in the field. These penetrations shall be core bit drilled of recommended diameter by seal manufacturer for each pipe size.
.6 Where pipes pass through walls and ceilings, install split type, chrome plated or spun aluminum escutcheons designed to fit around the pipe and the insulation, neatly against the wall or ceiling, completely concealing the sleeve. Fasten the escutcheons to the pipes with stainless steel set screws.
.7 Where pipes or sleeves are to be grouted in place, an approved non shrink, non-metallic grout mixture shall be used. All exposed non-metallic, non-shrink grout faces shall be left recessed 25 mm from final surface and will be fitted and finished with Portland Cement grout. Such sleeves or pipes shall not be disturbed until the grout is properly cured.

3.3 IDENTIFICATION

.1 Refer to Section 40 00 01 – General Process Provisions

3.4 CLEANING, FLUSHING AND DISINFECTION

.1 All material for potable water service must be cleaned, flushed, and properly disinfected prior to being put into service.

3.5 TESTING AND VERIFICATION

.1 Field testing of piping:
- .1 Provide all materials, equipment, tools and labor required to perform the tests specified herein.
- .2 Furnish certificate from manufacturer or approved laboratory verifying calibration and accuracy of test instruments.
- .3 Should any item fail testing, it will be corrected by the Contractor until a successful test is achieved.
- .4 All tests shall be witnessed by the Owner's Representative.
- .5 The Contractor shall be responsible for all equipment and components during testing and shall be liable for damage in the event of injury and/or property damage.
- .6 Provide temporary supports, if necessary, to support the weight of test liquid for piping designed for vapor or gas.
- .7 Provide temporary restraints or isolate expansion joints which cannot sustain the reactions due to test pressure.
- .8 All plugged ends shall be adequately reinforced to withstand test pressures.
- .9 Isolate from the piping, equipment that is not to be subjected to the test pressure.
- .10 Pipework may be tested as a whole or in sections.
- .11 The section of pipe to be tested shall be filled with clean water and have all air removed 24 hours prior to testing.
- .12 Immediately prior to testing, the pipe shall be checked for loss of water and filled accordingly. Great care shall be taken to ensure there are no trapped pockets of air.
- .13 All pipes shall be pressurized to 1034 kPa (150 psi), and the pressure shall hold constant for two hours with no appreciable pressure loss as determined by the Owner's Representative. Consideration should be given to air temperature differentials when testing with water.
- .14 If leaks are detected, at no cost to the Owner the Contractor shall repair and retest until no leakage is detected.
- .15 Drain piping following successful completion of testing.
- .16 Pipe test shall be using clean water at ambient temperature except where there is risk of damage due to freezing. Another fluid may be used (after being approved by the Owner's Representative) if it is safe for workmen and compatible with the piping material.
- .17 During testing all valves must be in the open position.
- .18 Leaks in screwed fittings shall be corrected by remaking joints, leaks in welded joints shall be cut out and re-welded, and leaks in copper lines shall be corrected by remaking joints. Caulking will not be permitted.
- .19 Furnish written test reports to the Owner's Representative noting the tests made and any adjustments or repairs that were made.

3.6 DEMONSTRATION AND TRAINING

.1 Not applicable.

3.7 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23.

3.8 SPARE PARTS

.1 Not applicable.

3.9 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials and installation of hangers and supports for equipment and piping.

.2 The Contractor shall provide all tools, supplies, materials, equipment, and all labor necessary for the design, furnishing, construction, and installation of all pipe supports, hangers, guides, and anchors, all shown or not shown on the tender drawings, specified, or required for a complete and operable piping system. The Contractor shall include in the tender cost all pipe supports whether they are shown or not shown on the drawings.

1.2 CONDITIONS AND DEFINITIONS

.1 None.

1.3 SUBMITTALS

.1 Product Data: Submit for each type of pipe hanger, support, guide, and anchor type by catalogue number.

.2 Shop Drawings: Drawings of piping and equipment support system, locating each support, brace, hanger, guide, component, and anchor. Signed and sealed by qualified professional engineer in the Province of Alberta.

.3 Submittals for information:
- .1 Welding Certificates: Copies of certificates for welding procedures and operators.
- .2 Certifications specified in Quality Assurance article

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Refer to and comply with Section 01 60 00 - Product Requirements.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 QUALITY ASSURANCE

.1 Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

.2 Contractor Engineering Responsibility: Design and preparation of Shop Drawings for piping support systems throughout the project whether shown on the Contract drawings or not.

.3 Professional Engineer Qualifications: Professional engineer legally qualified to practice in the Province of Alberta and experienced in providing engineering services for design and installation of hangers and supports.

.4 Certification letter: A letter, sealed and signed by qualified professional engineer licensed to practice engineering in the Province of Alberta, certifying conformity to the applicable governing codes and criteria specified in the Contract Documents.

2.4 PERFORMANCE REQUIREMENTS

.1 None.

2.5 PRODUCT REQUIREMENTS

.1 Design Requirements:
- .1 Seismic Load: Seismic loads and seismic performance category forces in accordance with local codes.
- .2 Meet requirements of MSS SP 58, MSS SP 69, and MSS SP 89, or as modified by this Section.
- .3 Comply with the support spacing as outlined in support spacing for PVC and stainless steel pipe included below.

.2 Support for PVC Piping:
- .1 Spacing of supports for PVC pipe shall not exceed the following:

Pipe Size (mm)	Maximum Spacing (m)	Pipe Size (mm)	Maximum Spacing (m)
Schedule 80		Schedule 40	
5 mm	1.2 m	5 mm	1.0 m
15 mm	1.2 m	15 mm	1.1 m
20 mm	1.3 m	20 mm	1.2 m
25 mm	1.4 m	25 mm	1.3 m
30 mm	1.5 m	30 mm	1.4 m
40 mm	1.6 m	40 mm	1.5 m
50 mm	1.7 m	50 mm	1.6 m
65 mm	1.8 m	65 mm	1.7 m
75 mm	2.0 m	75 mm	1.8 m
100 mm	2.2 m	100 mm	1.9 m
125 mm	2.4 m	125 mm	2.0 m
150 mm	2.6 m	150 mm	2.1 m
200 mm	2.8 m	200 mm	2.2 m
250 mm	3.0 m	250 mm	2.3 m
300 mm	3.2 m	300 mm	2.6 m
350 mm	3.3 m	350 mm	2.8 m
400 mm	3.5 m	400 mm	3.0 m

- .2 Standard pipe hangers and supports having a broad surface at the bearing point of the pipe and free of sharp edges in contact with the pipe shall be used. The spacing of hangers shall be in accordance with the pipe manufacturer's recommendations where temperatures do not exceed 140°F.
- .3 All valves and equipment shall be supported independently from the pipe. Valves shall be anchored to prevent the turning moment resulting from their operation from being transmitted to the pipe.

.4 Vertical risers shall be supported below the fitting shoulder at each 20 foot (6 m) length. Pipe passing through the walls, floors or partitions shall be sleeved and not securely anchored at these points.

.3 Support for Stainless Steel Piping:

.1 Spacing of supports for horizontal stainless steel shall not exceed the following:

Pipe Size	Rod Diameter	Spacing
25 mm to 100 mm	6.25 mm	2.4 meter
150 mm	10 mm	2.4 meter
200 mm and 250 mm	13 mm	3.0 meter
300 mm	16 mm	3.0 meter
350 mm and 400 mm	16 mm	3.6 meter
450 mm and 500 mm	19 mm	4.3 meter
600 mm	22 mm	4.3 meter

.4 General Hanger and Support Requirements:

.1 Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow for free expansion and contraction of the piping and shall prevent excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed so that they cannot become disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading, only.

.2 Hangers Subject to Horizontal Movements: At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit such movement. Where horizontal pipe movement is greater than 12 mm, or where the hanger rod deflection from the vertical is greater than 4 degrees from the cold to the hot position of the pipe, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.

.3 Riser Supports: Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

.4 Freestanding Piping: Free standing pipe connections to equipment, like chemical feeders, pumps, etc., shall be firmly attached to fabricated steel frames made of angles, channels, or I-beams anchored to the structure. Exterior, free standing overhead piping shall be supported on fabricated pipe stands, consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps, securing the pipes.

.5 Submerged Supports: All submerged piping shall be supported with hangers, brackets, clips, or fabricated supports and anchors of Type 316 Stainless Steel.

.6 Point Loads: All meters, valves, equipment, and other point loads shall be independently supported to prevent undue pipe stress and failure. No meter, valve, or other equipment shall be supported by the piping.

.7 All anchor bolts installed as part of a pipe support system, regardless of location or application, shall be manufactured of Type 316 Stainless Steel.

.8 All hanger rods, bolts, ubolts, turn buckles, aircraft cable, nuts, and washers shall be Type 316 stainless steel.

.9 Pipe supports for brass and copper pipe shall be copper plated, or insulators provided. Protection shall be in the form of a rubber insert between the pipe and the support.

.10 Rubber hose and flexible tubing shall be provided with continuous angle or channel support.

.11 Unless otherwise indicated on the drawings, piping shall be supported at a minimum of 50 mm out from the face of walls to the edge of the pipe and at least 75 mm below ceilings to the top of the pipe.
.12 Refer to individual equipment and piping specifications for any additional specific hanger requirements.
.13 Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

.5 Coating:
.1 Galvanizing: Unless specified to be fabricated of stainless steel, all fabricated pipe supports shall be blasted to a white, clean condition after fabrication and hot-dip galvanized in accordance with ASTM 123.
.2 Stainless Steel 316: all submerged, or has the potential to be submerged, pipe supports shall be stainless steel type 316.

.6 Hanger and Support Applications:
.1 Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install following types:
.1 Adjustable Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, 12 mm to 750 mm.
.2 Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, 20 mm to 600 mm, requiring clamp flexibility and up to 100 mm of insulation.
.3 Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, 12 mm to 600 mm, if little or no insulation is required.
.4 U-Bolts (MSS Type 24): For support of heavy pipe, 12 to 750 mm.
.5 Pipe Stanchion Saddles (MSS Type 37): For support of pipes, 100 to 900 mm, with stainless steel pipe base stanchion support and stainless floor flange and with U-bolt to retain pipe.
.6 Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, 65 mm to 900 mm, if vertical adjustment is required, with stainless steel pipe base stanchion support and stainless steel floor flange.
.2 Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install following types:
.1 Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, 75 mm to 500 mm.
.2 Riser Clamps (MSS Type 42): For support of pipe risers, 20 to 500 mm, if longer ends are required for riser clamps.
.3 Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install following types:
.1 Steel Turnbuckles (MSS Type 13): For adjustment up to 150 mm for heavy loads.
.2 Steel Clevises (MSS Type 14): For 49 °C to 232 °C piping installations.
.3 Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
.4 Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
.5 Steel Weldless Eye Nuts (MSS Type 17): For 49 °C to 232 °C piping installations.
.4 Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install following types:
.1 Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

.2 Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
.3 Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
.4 Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
.5 Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
.6 C-Clamps (MSS Type 23): For structural shapes.
.7 Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
.8 Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
.9 Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
.10 Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
.11 Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
.12 Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of following for indicated loads:
.1 Light (MSS Type 31): 750 pounds.
.2 Medium (MSS Type 32): 1500 pounds.
.3 Heavy (MSS Type 33): 3000 pounds.
.13 Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
.14 Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
.15 Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

.5 Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install following types:
.1 Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
.2 Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
.3 Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100 PSI minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

.6 Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install following types:
.1 Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
.2 Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
.3 Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
.4 Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
.5 Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

.6 Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
.7 Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
.8 Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include following types:
    .1 Horizontal (MSS Type 54): Mounted horizontally.
    .2 Vertical (MSS Type 55): Mounted vertically.
    .3 Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

2.6 PRODUCTS USED IN DESIGN

.1 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
    .1 Ensure that the performance and functionality of the specified system is maintained, and
    .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.7 MANUFACTURERS

.1 Acceptable Manufacturers
    .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
        .1 Sikla Framo 80.
        .2 Nibco Corp.
        .3 Anvil Corp.
        .4 National Pipe Hanger Corp.
        .5 Unistrut Corp.
        .6 Material Resources Inc.
    .2 Acceptable Manufacturers are selected based upon the following criteria
        .1 Performance / compatibility of supplied equipment
        .2 Historical level of service provided by the manufacturer
        .3 Historical level of service provided by the local distributors / representatives
        .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Design and fabricate framing supports when necessary to support pipes.

.3 Alternate or Substitute Products
    .1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Sections 01 70 00 and 01 79 00.

3.2 INSTALLATION

.1 Hanger and Support Installation:

.1 Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

.2 .Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

.1 Field assemble and install according to manufacturer's written instructions.

.3 Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

.1 Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

.2 Field fabricate from stainless steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

.4 Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

.5 Install power-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by power-actuated tool manufacturer. Install fasteners according to power-actuated tool manufacturer's operating manual.

.6 Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

.7 Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

.8 Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

.9 Support piping connections to equipment by pipe support and not by equipment.

.10 Support large or heavy valves, fittings, and appurtenances independently of connected piping.

.11 Support no pipe from pipe above it.

.12 Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.

.13 Do not install pipe supports and hangers in equipment access areas or bridge crane runs.

.14 Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after start-up.

.15 Install lateral supports for seismic loads at all changes in direction.

.16 Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.

.17 Repair mounting surfaces to original condition after attachments are made.

.18 Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

.19 Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 - Building Services Piping, is not exceeded.

.20 Insulated Piping: Comply with following:
- .1 Attach clamps and spacers to piping.
  - .1 Piping: Use thermal-hanger shield insert with clamp sized to match OD of insert.
  - .2 Do not exceed pipe stress limits according to ASME B31.9.
- .2 Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - .1 Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 100 mm and larger if pipe is installed on rollers.
- .3 Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields: Span arc of 180 degrees.
  - .1 Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 100 mm and larger if pipe is installed on rollers.
- .4 Shield Dimensions for Pipe: Not less than following:
  - .1 6 to 90 mm: 300 mm inches long and 1.2 mm thick.
  - .2 100 mm: 300 mm long and 1.5 mm thick.
  - .3 125 and 150 mm: 457 mm long and 1.5 mm thick.
  - .4 200 to 350 mm: 600 mm long and 1.90 mm thick.
  - .5 400 to 600 mm: 600 mm long and 2.66 mm thick.
- .5 Pipes 200 mm and Larger: Include wood inserts.
- .6 Insert Material: Length at least as long as protective shield.
- .7 Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- .8 All piping and ductwork supports are to be signed and installed to allow the insulation to be continuous through the hangers.

.21 Piping and ductwork supports are to be independent supports and directly supported to the building structure. Combining supports from more them one trade is not permitted.

.22 Install all pipe supporting and anchoring devices required.

.23 Pipe supports shall be installed where there may be expected to be abnormal or unreasonable thrust or stress imposed on structures or equipment.

.24 Hangers and supports shall; secure pipes in place, prevent vibration, maintain grade by adjustment, provide for expansion and contraction and appear neat.

.25 Care shall be taken to prevent piping stress from being transmitted to pump flanges during construction. To ensure this, the mating flanges to pumps shall not be bolted together until the pipe work and pipe supports are complete. The pump couplings shall be turned by hand before and after the flanges are bolted together. Any increased resistance to rotation of the pump coupling is a direct indication of pipe strains communicated to the pump casing. In the event of such occurrence, the pipes shall be reset and the hangers adjusted as necessary.

.26 Run all piping parallel to building lines.

.27 Where practicable, hang piping at same elevation with trapeze hangers.

.28 Install hangers to provide not less than 12 mm clear space between finished cover and adjacent work.

.29 Do not use perforated band iron, wire or chain as hangers. All hangers rods are to have machine thread, capable of vertical adjustment after pipe is erected.

.30 Hangers and supports for covered piping shall not injure or pierce insulation.

.31 Provide approved sheet metal shields to protect vapour barrier insulation at contact areas with hangers and supports.

.32 In all cases: supports, hangers, brackets, etc., shall be installed according to accepted practice and all applicable codes and standards with particular reference to the following:

.1 Manufacturer's Standardization Society MSS SP 58 "Pipe Hangers and Supports Materials and Design"

.2 Manufacturer's Standardization Society MSS SP 69 "Pipe Hangers and Supports Selection and Application"

.3 Manufacturer's Standardization Society MSS SP 89 "Pipe Hangers and Supports Fabrication and Installation Practices".

3.3 EQUIPMENT SUPPORTS

.1 Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

.2 Grouting: Place 25 mm thick grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

.1 Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

.2 Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

.3 Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with following:

.1 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

.2 Obtain fusion without undercut or overlap.

.3 Remove welding flux immediately.

.4 Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

.4 Metal Fabrications of steel to be hot dipped galvanized.

.5 Metal Fabrications of stainless steel to be pickled and passivated.

3.5 ADJUSTING

.1 Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 TESTING AND VERIFICATION

.1 Refer to and comply with Sections 01 70 00 and 01 79 00.

3.7 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23.

3.8 SPARE PARTS

.1 Not applicable.

3.9 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials and installation of all stainless steel pipes and tubing.

1.2 CONDITIONS AND DEFINITIONS

.1 Not applicable.

1.3 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 – Submittal Procedures.

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Refer to and comply with Section 01 60 00 - Product Requirements.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PRODUCT REQUIREMENTS

.1 It shall be the responsibility of the Contractor to furnish and install all piping systems specified herein and shown on the contract drawings. Each system shall be installed complete with all applicable fittings, hangers, supports, anchors, expansion joints, flexible connections, valves, and accessories to provide a functional system as designed. In addition, to all testing, disinfection and encasement shall be the responsibility of the Contractor.

.2 The Contractor shall provide all tools, equipment, materials, and supplies necessary and shall perform all labor necessary to complete the work specified herein and indicated on the drawings.

.3 The Contractor shall provide all testing apparatus necessary to perform testing as required by the contract documents. The Contractor shall provide any equipment necessary for inspection of and testing of piping systems specified.

.4 Piping shown on drawings and specified herein is intended to define the general layout, configuration, routing, pipe size and type only. It is the responsibility of the Contractor to provide a complete system in accordance with the contract drawings and requirements set forth herein. All details necessary to provide a complete system as specified herein are the responsibility of the Contractor. The Contractor shall provide all spools, spacers, adapters, connectors, and supports necessary to provide a complete and functional system. The Contractor shall furnish pipe supports, hangers, anchors, etc., in addition to those shown on the contract drawings, to provide a system as specified herein. The Contractor shall provide lay-out drawings of all piping systems prior to installation showing all piping, equipment, accessories, supports, etc.

.5 Pipe and Tubing

.1 Stainless Steel Piping and Fittings

Item	Size	Description
Interior Pipe	15mm to 65 mm	ASTM A312 Type 304L seamless or welded, Schedule 40S
	75 mm & larger	ASTM A778 Type 304L, welded, Sch 10S
Buried/Exterior Pipe or Pipe cast in walls	15mm to 65 mm	ASTM A312 Type 316 L seamless or welded, Schedule 40S
	75 mm & larger	ASTM A778 Type 316L, welded, Sch 40S
Pipe Joints	15 mm to 65 mm	Threaded, flanged or grooved at valves and equipment as required or shown on the drawings.
	75 mm & larger	Butt-welded, flanged or grooved at valves and equipment as required or shown on the drawings.
Pipe Fittings (for exterior or buried service provide type 316L)	15 mm to 65 mm	Threaded Forged: ASTM A182, Type 304L, 20700 kPa WOG.
	15 mm to 65 mm	Socket Weld Forged: ASTM A182, Type 304L, 20700 kPa WOG.
	75 mm & larger	ASTM A774 Type 304L welded. Dimensions conforming to ANSI B16.9 and MSS SP43. Fitting wall thickness to match adjoining pipe. Long radius elbows unless shown otherwise.
Tubing (for exterior or buried service provide type 316L)	6 mm to 10 mm	1.65 mm wall thickness, fully annealed, ASTM A269 Grade TP304L
	15 mm to 22 mm	2.1 mm wall thickness, fully annealed, ASTM A269 Grade TP304L
Pipe Branch Connections (for exterior or buried service provide type 316L)	ALL	Tee or reducing tee in conformance with Fittings above, Forged Weld-o-let, 13800 kPa WOG, ASTM A182, Grade F304L same inside diameter as branch pipe. Saddle in for branch connections must be a minimum of 2 pipe sizes smaller than the larger pipe.

Flanges (for exterior or buried service provide type 316L)	15 mm to 65 mm	Forged: ASTM A182 Grade F304L, Class 150, socket weld, raised face, ANSI B16.5 standard.
	75 mm & larger	ASTM A182 Slip on or Weld neck flange. ANSI B16.5 Class 150 or Class 300. As shown on the drawings.
Blind Flanges (for exterior or buried service provide type 316L)	15 mm to 600 mm	ASTM A182 Grade F304L, Class 150 or Class 300, raised face, ANSI B16.5 standard. As shown on the drawings.
	650 mm to 900 mm	ASTM A182 Grade F304L, Class 150 or Class 300, raised face, ANSI B16.47 standard. As shown on the drawings.
Grooved Couplings	40 mm to 600 mm	Not submerged: Couplings consist of ductile iron housing clamps to ASTM A536, coating to be hot dipped galvanizing. The gasket shall be C shaped (EPDM) to meet NSF 61. Use zinc electroplated steel bolts to ASTM A449 and nuts to ASTM A563. Submerged (or potential to be Submerged): Full type 316 stainless steel or if the stainless steel is not obtainable use ductile iron couplings epoxy coated to NSF 61 with stainless steel nuts and bolts to ASTM F593 and ASTM F594.
Underground Couplings	40 mm to 600 mm	Use the type as shown on the drawings Self-restraining type: Couplings consist of a ductile iron housing to ASTM A536 and coated with NSF-61 approved epoxy coating. The restraint system shall consist of gripping surfaces. The gasket to be NBR. The system shall meet AWWA C219, C111 and ASTM D2000. Dynamic movement joint: Consists of multiple grooved couplings to accommodate movement of up to 100mm. Use epoxy coated in accordance with AWWA C210, with EPDM gaskets and stainless steel nuts and bolts. All couplings are to be wrapped in Denso tape.
Underground insulation and protection	All	Minimum of 50mm thick 32 kg/m^3 polyurethane recovered with a double wrap (50% overlap) of High tack black polyethylene tape (Polyken 932)
Bolting	All	Type 304, ASTM A193, Grade B8M hex head bolts and ASTM A194 Grade 8M

		hex head nuts and type 304 Stainless Steel Washers. Nuts with integral washers are not acceptable.
Gaskets	All Flanges	3.2 mm thick Red Rubber, ring type for raised face flanges and full face type for flat face flanges.
Thread Lubricant	50 mm & smaller	Teflon tape and/or paste that complies with NSF 61

2.4 PRODUCTS USED IN DESIGN

.1 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
  .1 Ensure that the performance and functionality of the specified system is maintained, and
  .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
  .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
    .1 Pinacle Stainless Steel
    .2 Unified Alloys
    .3 Hymax
    .4 Robar
    .5 EBAA
  .2 Acceptable Manufacturers are selected based upon the following criteria.
    .1 Performance / compatibility of supplied equipment.
    .2 Historical level of service provided by the manufacturer .
    .3 Historical level of service provided by the local distributors / representatives.
    .4 Location of spare parts and repair / service facilities in proximity to the Place of Work.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Section 01 70 00.

3.2 INSTALLATION

.1 Execute as per Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping

.2 Provide hangers and supports as indicated on the Contract Drawings and as per Section 40 05 07 - Hangers and Supports for Process Piping and Tubing

.3 Pickling and Passivation
  .1 Following fabrication of stainless steel piping connections, all weld areas shall be pickled to remove all mill scale, weld inclusions, and colour, and passivated inside and out in conformance to ASTM A380.

.2 The Contractor shall submit the cleaning and passivation procedure of stainless steel piping system in compliance with the above requirements for Owner's Representative's review and approval.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 Pipes for potable water service shall be cleaned, flushed, and disinfected prior to be put into service.

3.4 TESTING AND VERIFICATION

.1 Refer to and comply with Section 40 05 06 Couplings, Adapters and Specials for Process Piping.

.2 Submit a written test report.

3.5 DEMONSTRATION AND TRAINING

.1 Not applicable.

3.6 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23.

3.7 SPARE PARTS

.1 Not applicable.

3.8 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section refers to materials and installation of all interior Process PVC pipes.

1.2 CONDITIONS AND DEFINITIONS

.1 Not applicable.

1.3 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 – Submittal Procedures.

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Refer to and comply with Section 01 60 00 - Product Requirements.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PRODUCT REQUIREMENTS

.1 It shall be the responsibility of the Contractor to furnish and install all piping systems specified herein and shown on the contract drawings. Each system shall be installed complete with all applicable fittings, hangers, supports, anchors, expansion joints, flexible connections, valves, and accessories to provide a functional system as designed. In addition, to all testing, disinfection and encasement shall be the responsibility of the Contractor.

.2 The Contractor shall provide all tools, equipment, materials, and supplies necessary and shall perform all labor necessary to complete the work specified herein and indicated on the drawings.

.3 The Contractor shall provide all testing apparatus necessary to perform testing as required by the contract documents. The Contractor shall provide any equipment necessary for inspection of and testing of piping systems specified.

.4 Piping shown on drawings and specified herein is intended to define the general layout, configuration, routing, pipe size and type only. It is the responsibility of the Contractor to provide a complete system in accordance with the contract drawings and requirements set forth herein. All details necessary to provide a complete system as specified herein are the responsibility of the Contractor. The Contractor shall provide all spools, spacers, adapters, connectors, and supports necessary to provide a complete and functional system. The Contractor shall furnish pipe supports, hangers, anchors, etc., in addition to those shown on the contract drawings, to provide a system as specified herein. The Contractor shall provide lay-out drawings of all piping systems prior to installation showing all piping, equipment, accessories, supports, etc.

.5 Pressure Service:
- .1 Basic Material: PVC, Temperature (Maximum): 60 °C, Design Pressure: 1034 kPa (150 psi)
- .2 Pipe - all sizes shall conform to: CSA B137.3 rigid PVC schedule 80 and ASTM D1785
- .3 Fittings - all sizes: PVC schedule 80 conforming to ASTM D1784, D2467 and D2464
- .4 Flanges - 32 mm to 400 mm: PVC slip-on Vanstone conforming to ANSI B16.5, Class 150.
- .5 Flange Gaskets: Flange gasket materials to be suitable for product handled.
- .6 Bolts:
  - .1 Studs: 304 Stainless Steel ASTM 193 Grade B8M.
  - .2 Nuts: 304 Stainless steel ASTM 194 Grade 8M.
  - .3 Washers: 304 Stainless Steel ANSI B18.22.1.
  - .4 Assemble with anti-seize compound.
- .7 Valves:
  - .1 32 mm and larger: Flanged metal body or plastic valves as described under their respective sections.
  - .2 25 mm and smaller: PVC valves to have socket end connection, to be Type 1, Grade 1 Cell Classification conforming to ASTM D 1784.

2.4 PRODUCTS USED IN DESIGN

.1 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
- .1 Ensure that the performance and functionality of the specified system is maintained, and
- .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner’s Representative or others are covered by the Contractor.

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
- .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
  - .1 IPEX
  - .2 Chemkor
  - .3 George Fischer
- .2 Acceptable Manufacturers are selected based upon the following criteria.
  - .1 Performance / compatibility of supplied equipment.
  - .2 Historical level of service provided by the manufacturer .
  - .3 Historical level of service provided by the local distributors / representatives.

.4 Location of spare parts and repair / service facilities in proximity to the Place of Work.

.2 Alternate or Substitute Products
.1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Section 01 70 00.

3.2 INSTALLATION

.1 Execute as per Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping.

.2 Provide hangers and supports as indicated on the Contract Drawings and as per Section 40 05 07 - Hangers and Supports for Process Piping and Tubing

.3 Install pipe and tubing in accordance with the pipe or tubing manufacturer's recommendations.

.4 PVC socket weld expansion joints to be installed on every 50 feet of straight run PVC pipe.

.5 Joints shall be made in accordance with the ASTM D2855 recommended practice for solvent cemented joints.

.6 For the support of piping and tubing refer to and comply with Section 40 05 07 Hangers and Supports for Process Piping.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 Pipe for potable water service shall be cleaned, flushed, and disinfected prior to be put into service.

3.4 TESTING AND VERIFICATION

.1 Refer to and comply with Section 40 05 06 Couplings, Adapters and Specials for Process Piping.

.2 Submit a written test report.

3.5 DEMONSTRATION AND TRAINING

.1 Not applicable.

3.6 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23.

3.7 SPARE PARTS

.1 Not applicable.

3.8 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 To define common requirements for all process valves to be procured and installed as part of the Work.

.2 The general and supplementary conditions of the contract, addenda, drawings and all other Sections of the Contract Documents shall form part of and be read in conjunction with this Section.

1.2 CONDITIONS AND DEFINITIONS

.1 The term “valve” and “process valve” are interchanged and shall have the same definition

.2 Other Sections provide details and requirements of valve types, referred to as “valve type specifications”.

.3 Valve type specifications contains a series of similar valve types, referred to by a three-digit number, prefixed by a “V” or a “FCV” or other abbreviations as found in the contract documents.

1.3 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 – Submittal Procedures.

.2 In addition to the items list within Section 01 33 00 – Submittal Procedures:
.1 Notes that illustrate the relationship between valves accessories

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Supply all valves to site within shipping containers with labeling in place.

.2 Inspect for damage and report in writing.

.3 When moving valves chains, cables and ropes shall not be placed through valve ports or attached to actuators / operators, cylinders or hand wheels. Slings shall be used either around the valve body or with bolts or rods through the flange bolt holes.

.4 Provide temporary protective coating on all cast iron and steel valves.

.5 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation of valve.

.6 Valves shall not be rested on cylinders, hand wheels or operating shafts.

.7 Protect valves from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of the completed system.

.8 Store as per the manufacturer's recommendations.

2 Products

2.1 COMPATIBILITY

.1 Compatibility issues with regards to fluids conveyed, operation, safety and service life are to be communicated to the Owner's Representative through the shop drawing review process, and recommendations for alternates provided.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PERFORMANCE REQUIREMENTS

.1 Refer to the individual valve specifications.

2.4 PRODUCT REQUIREMENTS

.1 Valve Identification:
- .1 Each valve shall bear the manufacturers name to trademark, size, flow direction, tag number if available, and reference symbol to indicate the service conditions for which the manufacturer guarantees the valve.
- .2 Fasten identification tags to each valve as shown within the Contract Document using small stainless steel chains.
- .3 Provide 40 mm high, 1.5 mm thick rectangular polished stainless steel identification tags with embossed black alpha-numeric identification markings minimum 35 mm high and 3.2 mm thick, mounted to be easily read
- .4 Each valve tag is to display the valve tag number only. The Contractor shall verify the valve tag list with the Owner's Representative via the submittals process prior to fabrication.

.2 Confirmation of Dimensions:
- .1 Coordinate valve diameter with pipework sizes provided within Process and Instrumentation Drawings.
- .2 Coordinated and confirm face to face dimensions of all valves, as well as the dimensions of the various valve actuators / operators, to avoid conflict with other scopes within the Work.
- .3 Contactor shall be responsible for adjustment of the connecting pipework to suit the valves supplied, in the event that the face-to-face dimensions or other details, vary from the Contract Documents.
- .4 Make adjustments such that centerlines of shafts shall remain as shown within the Contract Documents, provided that actuators / operators have suitable clearance from all other items within the Work.
- .5 Orient all valves within the piping to allow access to seat adjustment screws (where applicable), unless otherwise stated within the specific valve specification.

2.5 PRODUCTS USED IN DESIGN

.1 Refer to the individual valve specifications.

2.6 MANUFACTURERS

- .1 Acceptable Manufacturers are selected based upon the following criteria
  - .1 Performance / compatibility of supplied equipment

.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Alternate or Substitute Products
.1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Sections 01 45 16 and 01 70 00.

3.2 INSTALLATION

.1 All appurtenances, valves, operating units, controls, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified.

.2 All valves shall be adequately braced to prevent warpage and bending under the intended use.

.3 All valves shall be firmly supported to avoid undue stresses on the pipe and the valve itself.

.4 Before installing any valve, the pipeline shall be inspected to ensure that no foreign debris or objects are present or may work loose and prevent the valve from closing.

.5 All valves should be aligned carefully to avoid excessive strain on flanges.

.6 Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these accessories so that all components are compatible and operating properly.

.7 All valves shall be field tested following installation to demonstrate that the valve operates under field conditions in a manner consistent with the design of the system.

.8 All valves shall be installed to provide easy access for operation, removal, and maintenance, and to avoid conflicts between valve actuators / operators and structural members or handrails.

.9 All valves with a handle/operator over 1.5 m above the finished floor shall have a chain wheel operator and sufficient chain to allow for the opening and closing of the valve from floor level. The contractor shall provide chain hangers to keep operating chains out of walkways.

.10 PVC Valves
.1 Ensure that glue and materials used provide excellent chemical resistance to the commodity (liquid) flowing through the valve.
.2 Install valves in accordance with manufactures instructions, including but not limited to use of appropriate tools, torque and backing rings where applicable.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 Pipe and valves for potable water service must be cleaned, flushed, and disinfected prior to be placed into service.

3.4 TESTING AND VERIFICATION

.1 Refer to and comply with Sections 01 70 00 and 01 79 00.

3.5 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23.

3.6 SPARE PARTS

.1 Refer to individual valve specifications for requirements.

3.7 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section is intended to generally outline the requirements of knife gate valves.

1.2 CONDITIONS AND DEFINITIONS

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves

1.3 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 - Submittal Procedures.

.2 Refer to 40 05 51 – Common Requirements for Process Valves

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PERFORMANCE REQUIREMENTS

.1 V200 – Knife Gate Valve
- .1 Commodity – Wastewater
- .2 Operating Pressure Range – 0 to 1035 kPa (150 psi(g))
- .3 Operating Temperature Range – 0 to 25°C
- .4 Bidirectional Shutoff

2.4 PRODUCT REQUIREMENTS

.1 V200 – Knife Gate Valve
- .1 Body: Solid cast 316 Stainless Steel
- .2 Gate: Stainless Steel 316
- .3 Seat: Buna-N
- .4 Stem:
  - .1 Stainless Steel 316L,
  - .2 Rising,
  - .3 Stainless steel stem extension and
  - .4 Stainless steel intermediate supports.
- .5 Pedestal:
  - .1 Stainless steel
  - .2 Fasteners to be stainless steel
- .6 Manual 3:1 bevel gear operator with removable hand crank.
- .7 Fasteners: Stainless Steel 304
- .8 Ends: lugged to ASME/ANSI B16.5- class150 flanges
- .9 Topworks: Stainless Steel
- .10 Coating / Finishes

.1 Not applicable, all materials to be stainless steel for submerged service.

2.5 PRODUCTS USED IN DESIGN

.1 The Contract Documents are based upon the application a Wey Knife Gate, Model VL

2.6 MANUFACTURERS

.1 Acceptable Manufacturers
  .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
    .1 WEY
  .2 Acceptable Manufacturers are selected based upon the following criteria
    .1 Performance / compatibility of supplied equipment
    .2 Historical level of service provided by the manufacturer
    .3 Historical level of service provided by the local distributors / representatives
    .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Alternate or Substitute Products
  .1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Section 01 70 00 – Execution and Closeout Requirements.

3.2 INSTALLATION

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves.

3.3 TESTING AND VERIFICATION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements.

.2 Test to AWWA C520-10 standard.

3.4 DEMONSTRATION AND TRAINING

.1 Refer to and comply with Section 01 79 00 – Demonstration and Training.

3.5 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23 Operational and Maintenance Data.

3.6 SPARE PARTS

.1 Provide one complete valve for each type and size provided.

3.7 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section is intended to generally outline the requirements of ball valves.

1.2 CONDITIONS AND DEFINITIONS

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves

1.3 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 - Submittal Procedures.

.2 Refer to 40 05 51 – Common requirements for Valves

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Refer to and comply with Section 01 60 00 - Product Requirements.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PERFORMANCE REQUIREMENTS

.1 V116 - Stainless Steel Ball Valves
- .1 Commodity – Potable, Partially Treated, Raw or Waste Water
- .2 Size Range – 8mm to 50mm
- .3 Operating Pressure Range – 0 to 150 psi(g)
- .4 Operating Temperature Range – 0 to 25°C

.2 V118 – PVC Ball Valves
- .1 Commodity – Potable water, sump water and chemical service.
- .2 Size Range – 15mm to 80mm
- .3 Operating Pressure Range – 0 to 150 psi(g)
- .4 Operating Temperature Range – 0 to 25°C

2.4 PRODUCT REQUIREMENTS

.1 V116 – Stainless Steel Ball Valves
- .1 Commodity – Potable, Partially Treated, Raw and Waste Water
- .2 Valve Requirements:
  - .1 2 pc Full port, 1000 WOG minimum.
  - .2 Body, cap and ball Material: Stainless Steel to ASTM A351.
  - .3 Stem: Stainless steel to ASTM A276.
  - .4 Seat, gasket, thrust washer and packing: RPTFE.

.5 Connections: Threaded ANSI B1.20.1 (NPT).
.6 Stainless steel handle with locking plate.
.7 Blow out proof stem
.8 Installation: Allow both horizontal and vertical orientation
.3 Coating / Finishes
.1 Not applicable.

.2 V118 – PVC Ball Valves
.1 Commodity – Potable water, sump water and chemical service.
.2 Valve Requirements
.1 Body Material: One-piece PVC in accordance with ASTM D1784
.2 Ball Material: PVC in accordance with ASTM D1784
.3 Seals: EPDM, for chemical service refer to chemical system specification.
.4 Seats: PTFE, for chemical service refer to chemical system specification.
.5 Connections: True Union, Socket
.6 Installation: Allow both horizontal and vertical orientation
.3 Coating / Finishes
.1 Not applicable

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
.1 The following manufactures have been identified as potential suppliers of the required items / equipment.
.1 Stainless Steel Ball Valves
.1 Pinacle.
.2 Unified Alloys.
.3 Flow-tek.
.2 PVC Ball Valves
.1 Chemline Series Type 21 True Union Ball Valve
.2 IPEX VXE Series Ball Valve
.2 Acceptable Manufacturers are selected based upon the following criteria
.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Alternate or Substitute Products
.1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Section 01 70 00 – Execution and Closeout Requirements.

3.2 INSTALLATION

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements

.2 Refer to and comply with Section 46 02 01 – Disinfection of Water Structures and Process Piping.

3.4 TESTING AND VERIFICATION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements.

3.5 DEMONSTRATION AND TRAINING

.1 Refer to and comply with Section 01 79 00 – Demonstration and Training.

3.6 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23 Operational and Maintenance Data.

3.7 SPARE PARTS

.1 Provide one complete valve for each type and size provided

3.8 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 To provide the specific requirements for pump control and check service valves that will be provide within this scope of work.

1.2 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE, AND PROTECTION

.1 Refer to and comply with Section 01 60 00 - Product Requirements.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PERFORMANCE REQUIREMENTS

.1 V108 – Swing Check Valves
- .1 Commodity – Wastewater, Raw, Partially Treated and Potable Water
- .2 Operating Pressure Range – 0 to 150 psi(g)
- .3 Operating Temperature Range – 0 to 25°C
- .4 Shall be non-slam closing

.2 V209 – Pinch Valves
- .1 Commodity – Wastewater
- .2 Operating Temperature Range – 0 to 25°C

2.4 PRODUCT REQUIREMENTS

.1 V108 – Swing Check Valves
- .1 Valve Requirements
  - .1 Body and Cover Material: Ductile iron ASTM A536.
  - .2 Disc: One piece molded Buna-N, ASTM D2000-BG.
  - .3 Disc Accelerator: Type 302 stainless steel.
  - .4 Connections: Flanged Class 150 to ANSI B16.42.
  - .5 Backflow Actuator: T-handled Stainless steel screw type with a bronze bushing and Buna-N seals, rising stem to indicate position.
  - .6 Nuts, Bolts & Washers: Stainless Steel type 316
  - .7 Installation: Allow both horizontal and vertical orientation
- .2 Coating / Finishes
  - .1 Valve interior and exterior shall be coated to NSF/ANSI 61.
  - .2 Valve exterior shall be coated with fusion epoxy (blue color).

.2 V209 – Pinch Valve
  .1 Valve Requirements
    .1 Body Material: Supplier recommended for service
    .2 Elastomer Flange: to ANSI B16.5 and ANSI B16.47, Class 150 standards
    .3 Installation: Allow both horizontal and vertical orientation
  .2 Coating / Finishes
    .1 Not applicable

2.5 PRODUCTS USED IN DESIGN

.1 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
  .1 Ensure that the performance and functionality of the specified system is maintained, and
  .2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.6 MANUFACTURERS

.1 Acceptable Manufacturers
  .1 The following manufactures have been identified as potential suppliers of the required items / equipment:
    .1 V108 – Swing Check Valves
      .1 Val-Matic 7200 Surgebuster
    .2 V209 – Pinch Valve
      .1 Tideflex Series 35 – Flanged Check Valve
  .2 Acceptable Manufacturers are selected based upon the following criteria:
    .1 Performance / compatibility of supplied equipment.
    .2 Historical level of service provided by the manufacturer.
    .3 Historical level of service provided by the local distributors / representatives.
    .4 Location of spare parts and repair / service facilities in proximity to the Place of Work.

.2 Alternate or Substitute Products
  .1 Refer to and comply with Section 40 00 01 General Process Provisions

3 Execution

3.1 INSTALLATION

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves.

3.2 CLEANING, FLUSHING AND DISINFECTION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements.

3.3 TESTING AND VERIFICATION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements.

3.4 DEMONSTRATION AND TRAINING

.1 Refer to and comply with Section 01 79 00 – Demonstration and Training.

3.5 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23 Operational and Maintenance Data.

3.6 SPARE PARTS

.1 Provide one complete valve for each type of check valve and size provided.

3.7 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section is intended to generally outline the requirements for special application process valves.

1.2 CONDITIONS AND DEFINITIONS

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves

1.3 SUBMITTALS

.1 Refer to and comply with Section 01 33 00 - Submittal Procedures.

.2 Refer to 40 05 51 – Common requirements for Valves

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Refer to and comply with Section 01 60 00 - Product Requirements.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PERFORMANCE REQUIREMENTS

.1 V209 - Stainless Steel Mud Valves
- .1 Commodity – Partially Treated, Raw and Waste Water
- .2 Size Range – 75mm to 600mm
- .3 Operating Pressure Range – 0 to 1 psi(g)
- .4 Operating Temperature Range – 0 to 25°C

2.4 PRODUCT REQUIREMENTS

.1 V209 – Stainless Steel Mud Valves
- .1 Commodity – Partially Treated, Raw and Waste Water
- .2 Valve Requirements:
  - .1 Shall be of the heavy duty flanged type designed to provide a positive seal under both seating and unseating head conditions.
  - .2 Shall be non-rising stem style
  - .3 The body flange, yoke, guides and gate or plug shall be stainless steel type 316.
  - .4 The seat shall be SBR rubber and mechanically retained.
  - .5 All fasteners are to be stainless steel.
  - .6 The valve operating stem and lift nut shall be type 316 stainless steel.
    - .1 The stem shall have Acme threads.

.7 The base flange shall be drilled as per ANSI 125# standard and have a minimum thickness of 20mm. the flange shall be machined to provide a smooth seating surface.
.8 The valve shall be machined, assembled and tested for quality assurance.
.3 Coating / Finishes
.1 Passivated in accordance with ASTM A-380.

2.5 MANUFACTURERS

.1 Acceptable Manufacturers
.1 The following manufactures have been identified as potential suppliers of the required items / equipment.
.1 Stainless Steel Mud Valves
.1 Trumbull.
.2 Troy.
.2 Acceptable Manufacturers are selected based upon the following criteria
.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Alternate Products
.1 Refer to and comply with Section 01 25 13 Product Substitution

.3 Substitute Products
.1 Refer to and comply with Section 01 25 13 Product Substitution

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Section 01 70 00 – Execution and Closeout Requirements.

3.2 INSTALLATION

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements

.2 Refer to and comply with Section 46 02 01 – Disinfection of Water Structures and Process Piping.

3.4 TESTING AND VERIFICATION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements.

3.5 DEMONSTRATION AND TRAINING

.1 Refer to and comply with Section 01 79 00 – Demonstration and Training.

3.6 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23 Operational and Maintenance Data.

3.7 SPARE PARTS

.1 Provide one complete valve for each type and size provided

3.8 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

1 General

1.1 INTENT

.1 This Section is intended to generally outline the requirements of water and wastewater related air valves.

1.2 CONDITIONS AND DEFINITIONS

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves.

1.3 SUBMITTALS

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves.

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 NSF 61 & 60 REQUIREMENTS

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.3 PERFORMANCE REQUIREMENTS

.1 V193 – Sewage Combination Air/Vacuum Valves
  .1 Commodity – Wastewater and Sludge Water
  .1 Operating Pressure Range – 0 to 150 psi(g)
  .2 Temperature Range – 0 to 25°C

2.4 PRODUCT REQUIREMENTS

.1 V193 – Sewage Air Release Valve
  .1 Valve Requirements:
    .1 Valve to be a single body design with the same size inlet and outlet.
    .2 Valve shall be designed to allow large quantities of air to be released automatically and to allow air to re-enter to prevent a vacuum.
    .3 Valve to allow small volumes of air to be released when in operation through a smaller orifice.
    .4 Body and Cover Material: Cast iron ASTM A126 Class B.
    .5 Orifice, float, and linkage: Stainless Steel 316.
    .6 Orifice Button: Buna-N.
    .7 Connections: Threaded (NPT).
    .8 Nuts, Bolts & Washers: Stainless Steel 304.
    .9 Valve shall have two additional NPT connection for gauges, testing, and draining.
    .10 The cover shall be bolted to the valve body and sealed with a flat gasket. Resilient seats shall be replaceable and provide drip tight shut off to the valve full pressure rating.
    .11 Seat type shall be determined by the pipe line pressure, low durometer seat to be supplied for systems that have a maximum head of 50m.

.12 Valve shall be manufactured and tested in accordance with AWWA Standard C512.
.13 Installation: As per manufacturers instructions.
.2 Coating / Finishes
.1 Valve interior and exterior shall be coated to NSF/ANSI 61.
.2 Valve exterior shall be coated with fusion bonded epoxy (blue color).

2.5 PRODUCTS USED IN DESIGN

.1 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
.1 Ensure that the performance and functionality of the specified system is maintained, and
.2 Any costs for adjustment or changes to the design included within the Contract Documents by the Consultant or others are covered by the Contractor.

2.6 MANUFACTURERS

.1 Acceptable Manufacturers
.1 The following manufactures have been identified as potential suppliers of the required items / equipment.
.1 Val-Matic – model 802A.
.2 APCO – model 445 SCAV .
.2 Acceptable Manufacturers are selected based upon the following criteria
.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Alternate or Substitute Products
.1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Refer to and comply with Section 01 70 00 – Execution and Closeout Requirements.

3.2 INSTALLATION

.1 Refer to Section 40 05 51 – Common Requirements for Process Valves.

3.3 CLEANING, FLUSHING AND DISINFECTION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements

3.4 TESTING AND VERIFICATION

.1 Refer to and comply with Section 01 70 00 Execution and Closeout Requirements

3.5 DEMONSTRATION AND TRAINING

.1 Refer to and comply with Section 01 79 00 – Demonstration and Training.

3.6 OPERATION AND MAINTENANCE MANUALS

.1 Refer to and comply with Section 01 78 23 Operational and Maintenance Data

3.7 SPARE PARTS

3.8 Provide one complete valve for each type and size provided.

3.9 WARRANTY

.1 Refer to and comply with Section 00 73 00 Supplemental Conditions.

.2 A minimum of a 1 year warranty is required unless otherwise indicated.

END OF SECTION

DIVISION 42

MATERIAL HANDLING AND PROCESS EQUIPMENT

1 General

1.1 SECTION INCLUDES

.1 Cranes, Hoists and Lifts of the Following Type:
  .1 Gantry cranes.

1.2 REFERENCE STANDARDS

.1 Canadian institute of Steel Construction (CISC) Handbook of Steel Construction – 12th Edition 2021

.2 ASTM International Inc. (ASTM)
  .1 ASTM A36 - Carbon Structural Steel.
  .2 ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.
  .3 ASTM A490 - Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
  .4 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

.3 Canadian Standards Association (CSA International)
  .1 CSA B167-16, Overhead cranes, gantry cranes, monorails, hoists, and jib cranes.
  .2 CSA G40.20/G40.21 13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  .3 CSA G164 18, Hot Dip Galvanizing of Irregularly Shaped Articles.
  .4 CSA S16-19, Design of Steel Structures.
  .5 CSAS136 16, North American Specifications for the Design of Cold Formed Steel Structural Members.
  .6 CSA W47.1 19, Certification of Companies for Fusion Welding of Steel.
  .7 CSA W48 18, Filler Metals and Allied Materials for Metal Arc Welding.
  .8 CSA W55.3 08(R2018), Certification of Companies for Resistance Welding of Steel and Aluminum
  .9 CSA W59 18, Welded Steel Construction.

.4 Province of Alberta Occupational Health and Safety Code 191/2021 – Part 6 Cranes, Hoists, and Lifting Devices.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittals.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:
  .1 Describe capacities, performance, operation, and applied forces to foundation.
  .2 Preparation instructions and recommendations.
  .3 Storage and handling requirements and recommendations.
  .4 Installation methods.

.3 Shop Drawings: Submit signed and sealed shop drawings by a Professional Engineer registered in Alberta per APEGA authentication requirements.
  .1 Dimensions, weights, clearances, and electrical requirements.
  .2 Section drawings showing all components and materials of construction.
  .3 Wiring schematics and connection details.

.4 Sections Indicate size and description of components, materials, attachment devices, description of lifting device, and construction details.

.4 Manufacturer’s Instructions: Submit manufacturer’s installation instructions.

.5 Operation and Maintenance: Submit in accordance with Section 01 78 23 including:
.1 Manufacturer’s installation, operation, and maintenance instructions for all equipment.
.2 Local supplier and service depot, name, address, phone number, and contact person.
.3 Model numbers, names, types, dates of manufacture and serial numbers.
.4 Recommended spare parts list.

.6 Provide one year’s supply of lubricants.

.7 Provide all required written certifications from the manufacturer showing that the equipment is in compliance with all applicable codes and standards.

.8 After erection, provide an inspection and test report from the manufacturer’s service representation indicating that all lifting equipment is operating properly.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in designing and manufacturing cranes with 25 years successful experience.

.2 Installer Qualifications: Company experienced in assembly and installation of cranes with 5 years successful experience and acceptable to crane manufacturer.
.1 Perform welding by certified operators in accordance with CSA W59.
.2 Bolted connections shall be in accordance with CSA B167 and CSA S16.
.3 Clearly label crane with rated load capacity. Place label at height and location easily read from floor level and loading position.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

.1 Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace assemblies and components that fail in materials and workmanship within warranty period from date of Substantial Completion.
.1 5 years or 10,000 hours warranty for manual push-pull crane, jib crane, and gantry crane products to cover defects in materials and workmanship.

2 Products

2.1 MANUFACTURER

.1 Not used.

2.2 LIFTING DEVICE

.1 Heavy Duty Electric Chain Hoist
- .1 Quantity: 1
- .2 Maximum Capacity (Load & Tool): 1000 kg.
- .3 Maximum Lifting Speed Fully Loaded: 8.5m/minute.
- .4 Maximum Lift Range: 10.5m.
- .5 Lift Voltage: 220V / 440V / 575V
- .6 Hoist Motor: 2.4 H.P.
- .7 Lifting Media: Stainless Steel Chain
- .8 Suspension: Push/Pull Trolley
- .9 Chain Containers: UV resistant plastic
- .10 Operating Temperature: wet/dry conditions from minus 20 degrees Celsius to plus 30 degrees Celsius
- .11 Provide weather cover as required for exterior operation.
- .12 Provide shock absorbing end stop.
- .13 Provide latch hook.
- .14 Provide universal trolley adapter.

.2 Acceptable Manufacturers: Yale, Kito, STAHL, or approved alternate.

2.3 SHOP FINISHING

.1 Steel: Prepare steel crane components in accordance with the standard and apply yellow weather resistant finish.

.2 Aluminum: Mill finish.

.3 Provide spray can of matching color, air-drying paint for field touch-up.

3 Execution

3.1 EXAMINATION

.1 Do not begin installation until support structures have been properly prepared.

.2 Design and construction of reinforced concrete footings and slabs as detailed on Drawings and specified in other sections. Verify that accurate crane applied forces and anchor bolt patterns are provided for foundation design.

3.2 INSTALLATION

.1 Install units and accessories in accordance with manufacturer's instructions and approved shop drawings. Do not modify crane components in any manner without advance written approval by crane manufacturer.

.2 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.3 Clearances for Moving Crane Components:
.1 76 mm minimum vertical clearance from any overhead obstruction.
.2 51 mm minimum horizontal clearance from any lateral obstruction.

.4 If the equipment is used by the Contractor, it shall be restored to new condition prior to acceptance.

3.3 FIELD QUALITY CONTROL

.1 Perform field quality control testing as recommended by manufacturer. Move jib and hoist trolley through entire travel to ensure crane is clear of obstructions and moves freely and smoothly. Inspect installed crane. Verify all bolts are tight and lock washers fully compressed.

.2 Field test crane and accessories for operating functions. Ensure crane movement is smooth and proper. Adjust as required and correct deficiencies.

.3 Provide the services of the manufacturer’s representative to verify correct installation, start-up equipment, test equipment including operating through complete lifting and lowering cycle, and supply a written report certifying that the installation meets all requirements.

.4 Clean surfaces. If necessary, touch-up paint damage, scratches, and blemishes with manufacturer provided matching paint. Protect crane from other construction operations.

3.4 DEMONSTRATING AND TRAINING

.1 Provide demonstration and training session for Owner's representative covering operation and maintenance.

3.5 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools, and equipment barriers.

END OF SECTION

DIVISION 43

PROCESS AND LIQUID HANDLING

1 General

1.1 INTENT

.1 This specification includes general clauses applicable to the supply, installation and testing of the submersible wastewater pumps installed in the dry well sump.

1.2 SUBMITTALS

.1 Product Data: Submit manufacturer's literature for pump and motors.

.2 Submit local supplier and service depot name, address, phone number, and contact person.

.3 Submit the name of the pump manufacturer proposed for use, catalog sheets showing pump characteristics and dimensions, and the following items:

- .1 Dimensional and sectional drawings of each item of equipment and auxiliary apparatus to be furnished including flange diameters, flange thickness, alignment register dimensions and tolerances, number, and size of all exposed bolting along with bolt circle dimensions.
- .2 Literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the specifications.
- .3 Total weight of pump and motor.
- .4 Pump nameplate data.
- .5 Hydraulic test reports.

.4 Statement of equipment warranty.

.5 Submit manufacturer's certified rating curves showing pump characteristics including, at a minimum, the following from shutoff to run out at full speed conditions. This information shall be prepared specifically for the proposed pump at the proposed impeller diameter.

- .1 Pump capacity
- .2 Brake horsepower including shaft loss and thrust bearing loss.
- .3 Net positive suction head required.
- .4 Minimum submergence required.
- .5 Minimum flow.

.6 Submit report of installation, inspection, testing, and observations for the installed pump.

1.3 REFERENCES

.1 Hydraulic Institute Pump Standards.

.2 ANSI - American National Standards Institute

.3 ASTM - American Society for Testing and Materials

.4 IEEE - Institute of Electrical and Electronics Engineers

.5 NEMA - National Electrical Manufacturers Association

.6 CSA- Canadian Standards Association

2 Products

2.1 COMPATIBILITY

.1 Refer to and comply with Section 40 00 01 – General Process Provisions.

2.2 PERFORMANCE REQUIREMENTS

.1 Design pumps for continuous operation, or intermittently in typical wastewater service.

.2 Environmental design conditions:
- .1 Ambient air: 4 °C to 35 °C, 20% to 100% relative humidity.
- .2 Fluid temperatures: 2 °C to 20 °C.

.3 Design pump to Hydraulic Institute standards.

.4 Pump performance:
- .1 Pumps shall operate satisfactory without undue mechanical stress or vibration over their entire operating range.
- .2 Perform non-witness tests throughout the full capacity range, to Hydraulic Institute standards.
- .3 Design casing with design pressure equal to the maximum working pressure required by the pumping service, which may include shut-off condition or a combination of adverse conditions.
- .4 The pump(s) may be started and stopped against a closed valve on the discharge system. If any pump(s) offered for wastewater service require special operating limitations such as minimum flow condition, clearly state these limitations.
- .5 Design all pumps to permit rapid and economical maintenance.

.6 Sump Pump shall satisfy the following performance requirements:

Westbrook Pump Station	
Tag Number	Sump Pump
Discharge Flow	2.5 L/s
Total Dynamic Head	6.3 m
Minimum Pump Efficiency (at duty point)	75%
Operation	Fixed speed

2.3 PRODUCT REQUIREMENTS

.1 Pump Construction:
- .1 Pumps shall be submersible, vertical, single stage, bottom suction, non-clog, centrifugal type pump designed to be installed in dry well sump.
- .2 The pump/motor assembly shall have CSA approval.
- .3 Pump and motor shaft shall be the same unit and shall be made of AISI type 431 stainless steel throughout.

.4 All major parts, such as the stator casing, oil casing, volute, shall be of gray iron. All exposed bolts and nuts shall be stainless steel. All mating surfaces of major parts shall be machined and fitted with rubber O-ring seals where watertight sealing is required. All parts shall be interchangeable and watertight sealing shall not require additional machining of replacement parts, sealing compounds, or the application of specific torques to connectors

.2 Impeller:

.1 A wear ring system shall be installed to provide efficient sealing between the volute and impeller. The impeller shall be gray cast iron, BN 200 minimum, of non-clogging design, capable of handling solids, fibrous material, heavy sludge and other matter found in normal wastewater applications.

.2 The impeller shall be constructed with a long throughlet without acute turns. The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be a slip fit or taper fit to the shaft and key driven. Non corroding fasteners shall be used.

.3 Shaft Seals:

.1 Each pump shall be provided with a mechanical, rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated, lapped seal faces. The lower seal unit between the pump and oil chamber shall contain one stationary and one positively driven, rotating tungsten-carbide. The upper seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide and one positively driven rotating tungsten-carbide ring.

.2 Each interface shall be held in contact by its own independent spring system, supplemented by external liquid pressures. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. No seal damage shall result from operating the pumping unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication. The oil reservoir shall have a drain and inspection plug, with positive seal, which shall be easily accessible from outside the pump.

.4 Name Plate

.1 Stainless steel data plates stating manufacturer's name, pump size, speed, serial number, impeller diameter, rated capacity, and head.

.2 Name plates shall be securely attached to pump.

.5 MOTOR

.1 General:

.1 Pump motors shall be designed in accordance with the standards of NEMA to operate at a standard 40°C ambient temperature.

.2 The motor shall be designed for continuous duty capable of sustaining a minimum of 12 evenly spaced starts per hour.

.3 The motor shall be capable of operating the pump at any point on the pump curve without exceeding the motor nominal rating, and shall be capable of running unsubmerged continuously without damage to pump, seal or motor.

.4 Size motor for non-overload operation anywhere on pump performance curve (excluding service factor), and suitable for duty cycle requiring six motor starts per hour.

.5 The motor shall be housed in a watertight casing. The pump shaft shall be a one-piece, solid shaft of AISI 400 Series stainless steel and shall be completely isolated from the pumped liquid.

.6 The shaft shall be supported above and below the rotor by anti-friction bearings designed to provide long life and minimize shaft deflection. At least one bearing shall be double row type. Bearings shall have a minimum AFBMA B10 life of 40,000 hours.
.7 Motors shall have a maximum rotating speed of 1,800 RPM.
.8 Motor voltage to be 120 volts single phase 60 Hz.

.2 Factory Testing:
.1 Test in accordance with IEEE, CSA standards for submersible motors.

2.4 PRODUCTS USED IN DESIGN

.1 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must
.1 Ensure that the performance and functionality of the specified system is maintained, and
.2 Any costs for adjustment or changes to the design included within the Contract Documents by the Owner's Representative or others are covered by the Contractor.

2.5 MANUFACTURERS:

.1 Acceptable Manufacturers
.1 The following manufactures have been identified as potential suppliers of the required items / equipment.
.1 Flygt.
.2 Myers.
.3 Barnes.
.4 Hydromatic.
.5 Approved substitution.
.2 Acceptable Manufacturers are selected based upon the following criteria
.1 Performance / compatibility of supplied equipment
.2 Historical level of service provided by the manufacturer
.3 Historical level of service provided by the local distributors / representatives
.4 Location of spare parts and repair / service facilities in proximity to the Place of Work

.2 Quality Assurance
.1 Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.
.2 The pump manufacturer shall currently have maintenance and repair facilities established and in operation in Province of Alberta for a period of not less than five (5) years. Such facilities shall be fully equipped and staffed with qualified personnel for making repairs to damaged pumps and motors, and shall carry or have direct access to a full line of normal maintenance spare parts.

.3 Alternate or Substitute Products
.1 Refer to and comply with Section 40 00 01 General Process Provisions.

3 Execution

3.1 EXAMINATION

.1 Verify dimensions, tolerances, and method of attachment with other work.

3.2 INSTALLATION

.1 Install pumps to manufacturer's instructions, and the Hydraulic Institute Pump Standards

.2 Align pumps and pipe connections to avoid transmission of pipe weight or reactions to pumps.

END OF SECTION

1 General

1.1 INTENT

.1 To provide the specific requirements for submersible pumps, including motors, that will be provided within the Work.

1.2 CONDITIONS AND DEFINITIONS

.1 The term “pump” shall refer to all components of the pump including the motor, discharge connection, guide rails, lifting mechanisms, bowls, impeller etc.

.2 The term “pump assembly” shall refer to all components required to operate a pump including the motor, bowls, impeller, seals etc.

.3 The term “discharge connection” shall refer to the position where the pump discharge connection is located and where the pump connects onto the discharge pipework.

.4 Where referenced, apply the current (latest) version of the regulations, codes, standards, guidelines and publications

.5 The terms “Supplier” and “Manufacturer” are interchangeable and have the same definition.

1.3 SUBMITTALS

.1 Submittal requirements with shop drawings.
- .1 Pump’s minimum submergence.
- .2 Pump’s minimum flow.
- .3 Pump’s net positive suction head requirements.
- .4 Pump’s operating limitations and constraints
- .5 Details of the local parts supplier and service depot including name, address, phone number, and contact person.
- .6 Literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the specifications.

.2 Submit report of installation, inspection, testing, and observations for the installed pump.

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Inspect for damage and report in writing

.2 Store as per the manufacturer's recommendations

2 Products

2.1 OPERATING CONDITIONS / PARAMETERS

.1 Refer to Performance Requirements.

.2 Provide pumps for continuous and intermittent operation in environments and conditions that are typically found within a wastewater collection system and treatment process.

.3 Pumps shall allow continuous operation without overheating or damage to seals or watertight integrity.

.4 Pumps shall operate satisfactorily without undue mechanical stress or vibration over their entire operating range.

.5 The pump(s) may be started and stopped against a closed valve on the discharge system. If any pump(s) offered have any special operating limitations, clearly state these limitations as part of the Submittals.

.6 Pump Requirements

Number of Pumps Required	Two (2)
Tag Number	P-101, P-102
Installation	Wet Well
Commodity	Wastewater (municipal sewage)
Operating Temperature	0 to 25 ºC
Pump Type	Submersible Centrifugal
Duty Point	130 L/s @ 11.9 m TDH
Minimum Pump Efficiency (at Duty Point)	65.6%
Operation / Starter Type	Variable speed
Maximum Motor Size	35 HP (26 kW)
Voltage	575 V, 3 Ph, 60 Hz,
Rated Pump Speed	1,800 RPM
Discharge Connection Size	200 mm Diameter
Pump Electrical Classification	Class 1, Div 2, Group D
Sensors	Heat and moisture
Impeller	Stainless steel

.1 The required pump accessories are list below

2.2 PRODUCT REQUIREMENTS

.1 All pumps of this type shall be manufactured by the same company.

.2 Provide pumps to the latest version of the ANSI Hydraulic Institute Standards.

.3 Pump casings shall be provided with a design pressure equal to the maximum working pressure required by the pumping service, which may include shut-off condition or a combination of adverse conditions.

.4 Pump Requirements

.1 Pumps shall be submersible, vertical, single stage, bottom suction, non-clog, centrifugal type pump designed to be installed in a wet well sump.
.2 The pump/motor assembly shall have CSA approval.
.3 All major parts, such as the stator casing, oil casing, volute, shall be of cast iron to ASTM A-48, Class 35B.
.4 Pump & motor shaft shall be of Stainless Steel (AISI 420SS) material.
.5 Seal Plate shall of be of Cast Iron ASTM A48, Class 35B material.
.6 All external hardware shall be of Stainless Steel (AISI 316 SS).

.5 Impeller Requirements
.1 A wear plate system shall be installed to provide efficient sealing between the volute and impeller.
.2 The impeller shall be of Cast Iron ASTM A48ASTM A48, Class 35B material.
.3 The impeller shall be capable of non-clogging design, capable of handling solids, fibrous material, heavy sludge and other matter found in normal wastewater applications.
.4 The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it.
.5 The impeller shall be a slip fit or taper fit to the shaft and key driven. Non corroding fasteners shall be used.

.6 Shaft Seals Requirements
.1 Each pump shall be provided with a mechanical, rotating shaft seal system running in a hydraulic oil reservoir having separate, constantly hydro-dynamically lubricated, lapped seal faces.
.2 Each pump shall have its own seal failure sensor probe and detection system.
.3 Lower & Upper Mechanical Seals Material:
.4 Silicon Carbide / Silicon Carbide

.7 Motor Requirements
.1 Provide CSA approved, fully enclosed premium efficiency submersible, IP68 protection rating NEMA design B squirrel cage induction type motor, which is integral with the pump.
.2 The motor shall be capable of operating the pump at any point on the pump curve without exceeding the motor nominal rating
.3 Size motor for non-overload operation anywhere on pump performance curve (excluding service factor).
.4 Provide a motor capable of single speed or variable speed operation to meet pump performance requirements above.
.5 The motor shall be designed for continuous duty capable of sustaining a minimum of 15 evenly spaced starts per hour.

.8 Motor Construction:
.1 Speed: Specified within pump specific requirements above
.2 Power: Specified within pump specific requirements above
.3 Service Factors
.4 1.15 for dry pit and wet well installations
.5 Enclosure: NEMA design L with class F insulation copper windings
.6 Insulation resistance: Minimum 10 Megaohms, measured with a 500 V megger as a field test.

.9 Motor Protection
.1 Provide thermal protection

.1 Minimum normally closed bi metallic switch in each phase, connected in series. Thermal switches shall be set to open at 130°C ± 5°C.

.2 Provide leakage protection

.1 Moisture detection probe in seal sensing chamber to identify leakage into the stator housing.

.3 Provide interface / communications to PLC hardware for installation in Motor Control Center, including mounting brackets

.1 Control voltage to be 24VDC or 120VAC.

.10 Noise Performance: Maximum 80 dB (A) measured 1.5 meters from motor.

.11 Motor / Controls Cables

.1 Provide suitable sized / rated integrate pre-wired cables to a length of 15 m (49 ft).

.2 Cable shall provide connections for both power and controls.

.12 Connections

.1 All flange connections shall adhere to the ASTM / ANSI B-16.5 for Class 150 Flanges, unless otherwise stated.

.13 Coatings

.1 Provide internal and external epoxy coatings such that the pump is protected from the commodity.

.2 Provide a minimum thickness of 120 µm (4.7 ml.) Dry Film Thickness (DFT).

.14 Name Plate

.1 Refer to and comply with Section 40 05 93 Common Motor Requirements for Process Equipment.

2.3 ACCESSORIES

.1 The accessories listed below shall be provided by the Supplier for each individual pump:

.1 Discharge connection (base elbow) manufactured from Cast Iron to ASTM A48, with both internal and external surfaces epoxy powder coated or fusion bonded epoxy coated.

.2 Stainless Steel type 316 fasteners and fixings, including nuts, bolts, washers, and concrete anchors.

.3 Stainless steel type 316 guide bars, including

.1 Stainless steel intermediate (if required) and upper guide bar holders

.2 Stainless Steel fasteners and fixings, including nuts, bolts, washers, and concrete anchors.

2.4 PRODUCTS USED IN DESIGN

.1 The Contract Documents are based upon the application of the following equipment.

Tag Number	Make & Model
P-001, P-002	Fylgt NP2102 MT3~Adaptive 463

.2 Use of Products from Acceptable Manufacturers is permitted, however in using a Product from an Acceptable Manufacturer, the Contractor must

.1 Ensure that the performance and functionality of the specified system is maintained, and

.2 Any costs for adjustment or changes to the design included within the Contract Documents by the Consultant or others are covered by the Contractor.

2.5 MANUFACTURERS

.1 To simplify the familiarity, operation and maintenance of the Work, all submersible pumps specified in this section shall be furnished by and be the product of one manufacturer.

.2 Acceptable Manufacturers
- .1 The following manufactures have been identified as potential suppliers of the required items / equipment.
  - .1 Hydromatic
  - .2 Barnes
- .2 Acceptable Manufacturers are selected based upon the following criteria
  - .1 Performance / compatibility of supplied equipment
  - .2 Historical level of service provided by the manufacturer
  - .3 Historical level of service provided by the local distributors / representatives
  - .4 Location of spare parts and repair / service facilities in proximity to the Place of Work

3 Execution

3.1 INSTALLATION

.1 Refer and comply with Section 40 00 01 General Process Provisions.

.2 Install pumps in accordance with manufacturer's instructions and the Hydraulic Institute Pump Standards, latest edition.

.3 Align pumps and pipe connections to avoid transmission of pipe weight or force / reactions between both the pumps and the pipework.

.4 Refer to Demonstration and Training within this Section for required number of site visits.

.5 All components shall be fully tested and verified for service by the pump supplier or an authorized representative.

.6 The Contractor shall provide and install all supports, fasteners and fixings necessary to support the guiderails in accordance with the Supplier’s requirements.

3.2 HYDROSTATIC / PRESSURE TESTING

.1 Ensure that all pipework to be used in pump testing and verification, is successfully pressure tested prior to starting testing and verification.

.2 Refer to and comply with Section 40 00 01 General Process Provisions.

3.3 TESTING AND VERIFICATION

.1 Each pump assembly shall be factory / shop tested to include and confirm:
- .1 Current when pump is running unloaded (i.e. not pumping wastewater).
- .2 Locked rotor current.
- .3 Motor Resistance.
- .4 Bearing inspection

.2 Performance Testing
  .1 Once installed, operate each pump / motor by operating over a variety of operating conditions from shut-off to full flow.
  .2 Vary conditions to simulate all operating modes to verify performance.

.3 A field service technician or start-up engineer from the Supplier shall startup and verify the pumping equipment. Local manufacturer's representatives are not acceptable to perform these tasks unless trained and authorized by the Supplier

END OF SECTION

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