(FOR USE WHEN UNIT PRICES FORM THE BASIS OF PAYMENT TO BE USED ONLY WITH THE GENERAL CONDITIONS AND OTHER STANDARD DOCUMENTS OF THE UNIT PRICE MASTER MUNICIPAL CONSTRUCTION DOCUMENTS.)

**(TO BE READ WITH "INSTRUCTIONS TO TENDERERS - PART II"
CONTAINED IN THE EDITION OF THE PUBLICATION
"MASTER MUNICIPAL CONSTRUCTION DOCUMENTS" SPECIFIED IN ARTICLE 2.2 BELOW)**

Owner: Resort Municipality of Whistler
(NAME OF OWNER)

Contract: South Whistler Water Improvements Phase II
(TITLE OF CONTRACT)

Reference No. E20307
(OWNER'S CONTRACT REFERENCE NO.)

Introduction 1.0 These Instructions apply to and govern the preparation of tenders for this *Contract*. The *Contract* is generally for the following work:

The Project includes constructing the Work broadly described below, in accordance with the Contract Documents, with all related appurtenances. Work shown on the Drawings, or indicated in the Specifications, or indicated elsewhere in the Contract Documents is part of the Work, regardless of whether indicated below. The Work includes, but is not limited to the following:

1. Construction of a new potable water booster pump station and caustic soda chemical dosing facility to adjust pH in the drinking water supply system, including:
    a. Concrete foundations
    b. Masonry block building
    c. Pre-Engineered trusses
    d. Building envelope
2. Site development including:
    a. Excavation and site works
    b. Watermain tie-ins
    c. Drainage systems
    d. Paving
    e. Buried FRP tank
    f. Testing and flushing of new and existing watermains
3. Process mechanical including:
    a. Stainless steel piping
    b. 2 x 100hp vertical turbine pumps
    c. 30 hp groundwater pump

d. Pressure reducing and relief valves
e. Peristaltic metering pumps
f. Water softeners
g. Chemical process piping, valves and appurtenances
h. 2 x 12,000 L insulated FRP chemical tanks

4. Electrical work including
   a. MCC including VFDs, Power Distribution, breakers, MCP, PQM, SPD
   b. Building power distribution including conduit, cable trays and conductors
   c. Building lighting
5. Instrumentation and controls
   a. Instruments including flow meters, pressure elements, temperature elements, pH analyzers
   b. Fibre optic installed in existing conduit
   c. PLC controls, I/O cards and remote I/O

Direct all technical inquiries regarding the *Contract*, to:

Walt Bayless, P.Eng.
Project Manager
HDR Corporation
(778) 222-2813
Walter.bayless@hdrinc.com

Direct all general inquiries regarding the *Contract*, to:

Chelsey Roberts, AScT.
Capital Projects Manager, Infrastructure Services
Resort Municipality of Whistler
4325 Blackcomb Way
Whistler, BC, V8E 0X5
(604) 935-8305
croberts@whistler.ca

Tender Documents

2.0 The tender documents which a tenderer should review to prepare a tender consist of all of the *Contract Documents* listed in Schedule 1 entitled "Schedule of Contract Documents". Schedule 1 is attached to the Agreement which is included as part of the tender package. The *Contract Documents* include the drawings listed in Schedule 2 to the Agreement, entitled "List of *Contract Drawings*".

2.1 A portion of the *Contract Documents* are included by reference. Copies of these documents have not been included with the tender package.

These documents are the Instructions to Tenderers - Part II, General Conditions, Specifications and Standard Detail Drawings. They are those contained in the publication entitled "Master Municipal Construction Documents - General Conditions, Specifications and Standard Detail Drawings". Refer to Schedule 1 to the Agreement or, if not specified in Schedule 1, then the applicable edition shall be the most recent edition as of the date of the *Tender Closing Date.* All sections of this publication are by reference included in the *Contract Documents*.

2.2 Any additional information made available to tenderers prior to the *Tender Closing Time* by the *Owner* or representative of the *Owner*, such as geotechnical reports or as-built plans, which is not expressly included in Schedule 1 or Schedule 2 to the Agreement, is not included in the *Contract Documents*. Such additional information is made available only for the assistance of tenderers who must make their own judgment about its reliability, accuracy, completeness and relevance to the *Contract*, and neither the *Owner* nor any representative of the *Owner* gives any guarantee or representation that the additional information is reliable, accurate, complete or relevant.

2.3 **The *Contract Documents* are available for viewing at:**
Resort Municipality of Whistler
Municipal Hall
4325 Blackcomb Way
Whistler, BC, V0N 1B4

The *Contract Documents* are available *online* at:
This tender is being issued electronically through the RMOW website (www.whistler.ca) where any interested party may download the Tender documents directly from the aforementioned website. No registration, tracking or other recording of Tender document holders will be performed by the Resort Municipality of Whistler. All addenda, amendments or further information will be published on the RMOW website and BC Bid website. It is the sole responsibility of the Tenderer to monitor the website regularly to check for updates.

Submission of Tenders 3.0 Tender must be submitted by email must indicate the Tender title and contract number in the subject line and the full legal name of the Tenderer in the body of the email and received at:

engineerbids@whistler.ca

on or before:

Tender Closing Time: 2:00 pm local time

Tender Closing Date: **October 17, 2023**

Tenderers should note that the maximum acceptable email size is 8MB. If greater than 8MB, Tenderers should email bids in multiple emails. If sending in multiple emails, each email should indicate the total number of emails that are being sent. All emails must be received prior to the Submission Deadline. Responses are to be prominently marked with the Tender title and contract number, and the full legal name and return address of the respondent.

Late tenders will not be accepted or considered and will be returned unopened.

Additional Instructions to Tenderers 4.1 Copies of the Master Municipal Construction Documents Volume II, Instructions to Tenderers - Part II, General Conditions, Specifications and Standard Detail Drawings are available separately from:

Master Municipal Construction Documents Association
Suite 102
211 Columbia St.
Vancouver, BC V6A 2R5
www.mmcd.net
604.601.5103

Evaluation Criteria 4.2 The *Owner* reserves the right to waive informalities in or reject any or all tenders or accept the tender deemed most favourable in the interests of the *Owner*. Tenders will be evaluated on the combination of information provided in the Form of Tender and Appendices, which may offer the best value and not necessarily the lowest price. The Municipality reserves the right to conduct pre-selection meetings with Tenderers. The Municipality further reserves the right to conduct post-selection meetings in order to correct, change or adapt the selected Tender to the wishes of the Municipality. **Acceptance of any tender may be subject to budgetary considerations and/or Municipality approval, and/or the approval of other jurisdictions having authority.**

Site Meeting 4.3 A non-mandatory pre-tender site meeting will be provided by the Resort Municipality of Whistler and access will be provided to the existing facilities.

Site Meeting Time: 1:00 pm local time
Site Meeting Date: **October 5th, 2023**
Site Meeting Date: 1135 Cheakamus Lake Road *(located along the WWTP access driveway)*

Deletion / Addition of Work 4.4 Tenderers are advised that the *Owner* may, at its option, and subject to available funding and budgetary considerations, delete any *Work* described in the *Contract Documents* or may require that optional work be added to the scope of *Work*.

Omissions and Discrepancies 4.5 Should a tenderer find omissions from or discrepancies in the Contract Documents, or be in doubt as to their meaning, the tenderer should notify the Owner prior to the tender closing, who may cause to send a written instruction to all tenderers in the form of an addendum, which shall become part of the contract and shall be covered in the contract price. Failure to do so may result in the forfeiture of the Bid Security. No oral interpretations made to a tenderer as to the meaning of the Contract Documents shall be considered binding. Every request for an interpretation shall be made in writing, forwarded to the office referred to in paragraph 3.1 of the Instructions to Tenderers -Part 1.

Measurement and Payment 4.6 Delete all 'Measurement and Payment' Clauses from the MMCD Volume II, Master Municipal Specifications. Refer to Supplemental Specification 01 22 00 MEASUREMENT AND PAYMENT.

Tender Requirements 5.0 **IT – Part II 5 is amended by the following, as applicable.**

5.2.3. **A Consent of Surety**

The Contractor shall provide a Consent of Surety for the issue of a Performance Bond and a Labour and Material Payment Bond, each in the amount of 50% of the Contract Price, covering the performance of the Work, including the Contractor's obligations during the Maintenance Period, issued by a surety licensed to carry on the business of suretyship in the province of British Columbia, and in a form acceptable to the Owner.

8 **IT – Part II 8 is amended by the following, as applicable.**

8.1 **Examination and Site Inspection**

The Tenderer must examine the Place of Work before submitting their tender, either personally or through a representative, and satisfy themselves as to the nature and location of the work, local conditions, soil structure, topography, the nature and quality of the materials to be used, the equipment and facilities needed preliminarily to and during the prosecution of the work, the means of access to the site, all necessary information as to risks, contingencies and circumstances as may affect their tender, and all other matters which can in any way affect the work under this Contract. The Tenderer is fully responsible for conducting sufficient field investigation (test pits/bore holes) and obtaining all information required for the preparation of their tender and for the execution of the work. By submitting a tender, the Tenderer represents that the Tenderer has examined the Place of the Work, or specifically elected not to. No additional payments or time extensions shall be claimable or due because of difficulties relating to conditions at the Place of the Work which were reasonably foreseeable by a contractor qualified to undertake the Work.

12 **IT – Part II 12 is amended by the following, as applicable.**

12.S Amendments to Tenders

Change “hand, mail, or fax” to “hand or mail” and add “An amendment by email or fax will not be accepted.”

15 **IT – Part II 15 is amended by the following, as applicable**

15.1S **Award**

Replace 15.1 with:

“The Owner reserves the full right, in its sole discretion and according to its own judgement of its best interest to

1. reject any or all tenders;
2. waive any defect or deficiency in a tender which does not materially affect the tender or the Tender Price relative to other tenders and accept that tender;
3. accept any tender, including an Alternative Tender which , in accordance with paragraph 6.3 of these Instructions to Tenderers - Part II, the Owner may accept.

In exercising its discretion the Owner will have regard to the information provided in the Form of Tender, Form of Tender Appendices, and any information obtained by the Owner from any other person, firm or corporation relating to their previous experience with the tenderer, as well as the Owner's previous relevant experience, if any, with the tenderer, including but not limited to, the following criteria:

a) the proven experience of the tenderer, and any listed subcontractors to do the Work;
b) the tenderer's ability to complete the Work within the Preliminary Construction Schedule including timeliness in completing deficiency works;
c) the tenderer's ability to work effectively with the Owner, its consultants and representatives, and the public;
d) the tenderer's ability to manage and do the work effectively using the named superintendent and submitted contractors and subcontractors;
e) the tenderer's history on other projects including with respect to quality of the Work, changes in the Work, force account Work, cooperation with the Owner, and the contract administration costs of the Owner;
f) the nature of any legal proceedings undertaken by the tenderer, or any officer or director of the tenderer directly (or indirectly through another corporation) against the Owner within the last five years of the Invitation to Tender

In no event shall the Owner be liable for a tenderer's costs of preparing a tender.

The award of this Contract is subject to approval by Council."

15.4S **Award**

Insert the following clauses:

"Without limiting the generality of the foregoing, any tender which is incomplete, obscure or irregular may be rejected; any tender having erasures or corrections in the Form of Tender: Appendix 1, Schedule of Quantities & Prices may be rejected; any tender in which unit prices are omitted or in which unit prices are obviously unbalanced may be rejected; any tender accompanied by an insufficient bond may be rejected; any tender that has any deletions, alterations, or changes in

the Contract Documents as listed in Schedule 1 and 2 of the Agreement may be rejected."

Watermain Testing Procedure

The Contractor is to be aware that a testing written procedure is required as part of the watermain testing process. Refer to Supplementary Specifications Section 33 11 01S - 3.17.7 for detailed requirements.

Traffic Management

Tenderers are to be made aware that the *Owner* requires all traffic control plans to be submitted to the *Owner* prior to any lane or road closures being put into effect. The tenderer is advised to refer to Supplemental Specification 01 55 01S.

Materials Testing

The Contractor is advised that they are responsible for Quality Assurance testing.

Owner:	Resort Municipality of Whistler
Contract:	South Whistler Water Improvements Phase II
Reference No.	E20307

To *Owner*:

WE, THE UNDERSIGNED:

1.1 have received and carefully reviewed all of the *Contract Documents*, including the Instructions to Tenderers, the specified edition of the "Master Municipal Construction Documents - General Conditions, Specifications and Standard Detail Drawings" and the following Addenda:

_____

_____

_____ ;

(ADDENDA, IF ANY)

1.2 have full knowledge of the *Place of the Work*, and the *Work* required; and

1.3 have complied with the Instructions to Tenderers; and

ACCORDINGLY WE HEREBY OFFER:

2.1 to perform and complete all of the *Work* and to provide all the labour, equipment and material all as set out in the *Contract Documents*, in strict compliance with the *Contract Documents*; and

2.2 to achieve Substantial Performance of the Work on or before **May 30, 2024**

2.3 to do the *Work* for the price, which is the sum of the products of the actual quantities incorporated into the *Work* and the appropriate unit prices set out in Appendix 1, the "*Schedule of Quantities and Prices*", plus any lump sums or specific prices and adjustment amounts as provided by the *Contract Documents*. For the purposes of tender comparison, our offer is to complete the *Work* for the "*Tender Price*" as set out on Appendix 1 of this Form of Tender. Our *Tender Price* is based on the estimated quantities listed in the *Schedule of Quantities and Prices*, and excludes *GST*.

WE CONFIRM:

3.1 that we understand and agree that the quantities as listed in the *Schedule of Quantities and Prices* are estimated, and that the actual quantities will vary.

WE CONFIRM:

4.1 that the following appendices are attached to and form a part of this tender:

- the appendices as required by paragraph 5.3 of the Instructions to Tenderers – Part II; and
- the Bid Security as required by paragraph 5.2 of the Instructions to Tenderers – Part II.

WE AGREE:

5.1 that this tender will be irrevocable and open for acceptance by the *Owner* for a period of 60 calendar days from the day following the *Tender Closing Date and Time*, even if the tender of another tenderer is accepted by the *Owner*. If within this period the *Owner* delivers a written notice ("*Notice of Award*") by which the *Owner* accepts our tender we will:

- within 15 Days of receipt of the written Notice of Award deliver to the Owner:

  .1 a Performance Bond and a Labour and Material Payment Bond, each in the amount of 50% of the Contract Price, covering the performance of the Work including the Contractor's obligations during the Maintenance Period, issued by a surety licensed to carry on the business of suretyship in the province of British Columbia, and in a form acceptable to the Owner;

  .2 a Baseline Construction Schedule, as provided by GC 4.6.1;

  .3 a "clearance letter" indicating that the tenderer is in Worksafe BC compliance; and

  .4 a copy of the insurance policies as specified in GC 24 indicating that all such insurance coverage is in place and;

- within two Days of receipt of written "Notice to Proceed", or such longer time as may be otherwise specified in the Notice to Proceed, commence the Work; and

5.1.3 sign the Contract Documents as required by GC 2.1.2.

WE AGREE:

6.1 that, if we receive written *Notice of Award* of this *Contract* and, contrary to paragraph 5 of this Form of Tender, we:

- fail or refuse to deliver the documents as specified by paragraph 5.1.1 of this Form of Tender; or

- fail or refuse to commence the Work as required by the Notice to Proceed,

then such failure or refusal will be deemed to be a refusal by us to enter into the *Contract* and the *Owner* may, on written notice to us, award the *Contract* to another party. We further agree that, as full compensation on account of damages suffered by the *Owner* because of such failure or refusal, the *Bid Security* shall be forfeited to the *Owner*, in an amount equal to the lesser of:

- the face value of the Bid Security; and
- the amount by which our Tender Price is less than the amount for which the Owner contracts with another party to perform the Work.

OUR ADDRESS IS AS FOLLOWS:

_____

_____

_____

Phone: _____

Fax: _____

Attention: _____

This Tender is executed this _____ day of _____, 20 .

Contractor:

_____

(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

_____

(AUTHORIZED SIGNATORY)

_____

(AUTHORIZED SIGNATORY)

South Whistler Water Improvements Phase II

(TITLE OF CONTRACT)

(All prices and *Quotations* including the *Contract Price* shall include all *Taxes*, but shall not include *GST*, *GST* shall be shown separately.)

PART 1 – LUMP SUM ITEMS					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT PRICE**	**AMOUNT**
1	**General Requirements (Division 01)**				
	a) Bonds/Securities/Insurance	Lump Sum	1		
	b) Mobilization/Demobilization	Lump Sum	1		
	c) Temporary Facilities	Lump Sum	1		
	d) Administration	Lump Sum	1		
	e) Survey and Layout	Lump Sum	1		
	f) All other general requirements	Lump Sum	1		
	Sub-Total Item 1 – General Requirements:				
2	**Demolition (Division 02)**				
2.1	Demolition Works	Lump Sum	1		
	Subtotal Item 2 – Demolition:				
3	**Concrete and Masonry (Division 03 & 04)**				
3.1	Concrete Works	Lump Sum	1		
3.2	Masonry Block Wall Construction	Lump Sum	1		
3.3	Pre-engineered Wood Trusses	Lump Sum	1		
	Subtotal Item 3 – Concrete & Masonry:				
4	**Metals (Division 05)**				
4.1	Miscellaneous Metals	Lump Sum	1		

	Subtotal Item 4 – Metals:				
5	**Rough Carpentry (Division 06)**				
5.1	Rough Carpentry	Lump Sum	1		
	Subtotal Item 5 – Rough Carpentry:				
6	**Thermal and Moisture Protection (Division 07)**				
6.1	Wall envelope work	Lump Sum	1		
6.2	Roof Systems	Lump Sum	1		
	Subtotal Item 6 – Thermal and Moisture Protection:				
7	**Openings and Finishes (Division 08 & 09)**				
7.1	Doors and hardware	Lump Sum	1		
7.2	Epoxy floor finishes	Lump Sum	1		
7.3	Painting	Lump Sum	1		
	Subtotal Item 7 - Openings and Finishes:				
8	**Specialties (Division 10)**				
8.1	Portable fire extinguishers	Lump Sum	1		
	Subtotal Item 8 – Specialties:				
9	**Equipment (Division 11)**				
9.1	Supply and Installation of Chemical Storage Tanks	Lump Sum	1		
	Subtotal Item 9 – Equipment:				
10	**Process Interconnections and Controls (Division 40)**				
10.1	Process mechanical piping work	Lump Sum	1		
10.2	Supply and installation of chemical process piping	Lump Sum	1		
10.3	Softened water chemical piping including injection appurtenances	Lump Sum	1		

10.4	Water softener, brine tank, and interconnecting piping	Lump Sum	1		
10.5	Process piping demolition and modification at P279 pump station	Lump Sum	1		
10.6	Process piping demolition and modification as W212 control building	Lump Sum	1		
	Subtotal Item 10 – Process Interconnections and Controls:				
11	**Process Gas and Liquid Handling (Division 43)**				
11.1	Supply and installation of vertical turbine booster pumps	Lump Sum	1		
11.2	Removal, supply and installation of W212 submersible well pump	Lump Sum	1		
11.3	Air compressor	Lump Sum	1		
	Subtotal Item 11 – Process Gas and Liquid Handling:				
12	**Plumbing Systems (Division 22)**				
12.1	Installation of plumbing systems	Lump Sum	1		
	Subtotal Item 12 – Plumbing Systems:				
13	**Electrical Systems (Division 26)**				
13.1	Installation of new electrical MCC equipment	Lump Sum	1		
13.2	Lighting systems	Lump Sum	1		
13.3	Interior power distribution	Lump Sum	1		
13.4	Exterior power systems	Lump Sum	1		
	Subtotal Item 13 – Electrical Systems:				
14	**Civil, Including Buried Tanks, Piping And Earthworks (Division 31, 32, 33)**				
14.1	Supply and installation of secondary containment waste tank	Lump Sum	1		
14.2	Installation of yard piping/watermains at the project site	Lump Sum	1		

14.3	Excavations work	Lump Sum	1		
14.4	Grading and Paving	Lump Sum	1		
	Subtotal Item 14 – Civil, Including Buried Tanks, Piping And Earthworks:				
15	**HVAC Systems (Division 43)**				
15.1	Installation of heating and ventilation system	Lump Sum	1		
	Subtotal Item 15 – HVAC Systems:				
16	**Water and Wastewater Equipment (Division 46)**				
16.1	Chemical Feed – Liquid Systems	Lump Sum	1		
	Subtotal Item 16 – Water and Wastewater Equipment:				
	PART 1 - TENDER PRICE				

PART 2 – PROVISIONAL ITEMS					
ITEM	**DESCRIPTION**	**UNIT**	**QTY**	**UNIT PRICE**	**AMOUNT**
1	**Provisional Items**				
	a) Rock Removal per MMCD 31 23 17	M3	50		
	b) Over Excavation and Backfill	M3	50		
	PART 2 - TENDER PRICE				

TENDER SUMMARY	
TENDER PRICE (PART 1 + PART 2)	
GST (5%)	
TOTAL TENDER PRICE	

South Whistler Water Improvements Phase II

(TITLE OF CONTRACT)

See paragraph 5.3.2 of the Instructions to Tenderers – Part II.

Indicate Schedule with bar chart with major item descriptions and time.

MILESTONE DATES: Substantial performance by October 31, 2024

ACTIVITY	CONSTRUCTION SCHEDULE									
	1	2	3	4	5	6	7	8	9	10
Mobilization to Site										
Demolition										
Concrete and Masonry										
Metals										
Rough Carpentry										
Thermal and Moisture Protection										
Openings and Finishes										
Specialties										
Equipment										
Process Interconnections and Controls										
Process Gas and Liquid Handling										
Plumbing systems										
Electrical Systems										
Civil, including buried tanks, piping and earthworks										
HVAC systems										
Water and Wastewater Equipment										
Restoration										
Demobilization										

E20307South Whistler Water Improvements Phase II

(TITLE OF CONTRACT)

See paragraph 5.3.3 of the Instructions to Tenderers – Part II.

Superintendent Name:

Project Name:	
Dates:	
Responsibility:	
References:	
Project Name:	
Dates:	
Responsibility:	
References:	
Project Name:	
Dates:	
Responsibility:	
References:	

South Whistler Water Improvements Phase II
(TITLE OF CONTRACT)

See paragraph 5.3.4 of the Instructions to Tenderers – Part II.

PROJECT	OWNER / CONTACT NAME PHONE and FAX	WORK DESCRIPTION	VALUE ($)
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		
	Owner / Contract ______ Phone ( ) ______ Fax ( ) ______		

South Whistler Water Improvements Phase II

(TITLE OF CONTRACT)

See paragraph 5.3.5 of the Instructions to Tenderers – Part II.

TENDER ITEM	TRADE	SUBCONTRACTOR NAME	PHONE NUMBER

SUPPLEMENTARY GENERAL CONDITIONS

GC #	Parag #	Title	Action
(a) MMCD STANDARD			
1.0	1.21	Definitions	**Replace with:** "Contract Administrator" means the person appointed by the Owner and identified by the Owner in writing to the Contractor. The Contract Administrator may be an officer of the Owner, a direct employee of the Owner, an officer or employee of the consultant who designed the Work for the Owner, or an independent consultant.
1.0	1.30	Definitions	**Delete** GC 1.30.1 "Deleted Items"
1.0	1.45	Definitions	**"Milestone Date"** means any date specified in the Contract Documents for completion of the Work, or portion of the Work, including the dates of Substantial Performance and Total Performance.
2.0	2.2	Interpretation	**Replace** GC 2.2.4 (1) (i) **with:** "Standard Detail Drawings"
3.0	3.4	Inspection and Site Inspector	**Replace** GC 3.4.5 **with:** If at any time and for any reason the Contract Administrator determines that inspection or testing of the Work, or portion of the Work, is required that was not called for in the Contract Documents, then the Contract Administrator may direct the Contractor to perform, or have performed, that inspection or testing, as provided in GC 4.12.6.
	4.6	Construction Schedule	**Replace** GC 4.6.2 **with:** The Contractor shall update the Baseline Construction Schedule monthly to produce an adjusted Baseline Schedule (the "Adjusted Baseline Schedule") that reflects any adjustments to the Milestone Date(s) or the Contract Time as provided by the Contract Documents, including without limitation if the Contract Administrator issues a Change Order or other Contract Document(s) which adjusts any Milestone Date(s). Each Adjusted Baseline Schedule will replace the previous Baseline Construction Schedule.
	4.6	Construction Schedule	**Replace** GC 4.6.6 **with**: The time for the performance of the Work shall commence on the date specified in the Notice to Proceed, or if not so

			specified, on the date the Notice to Proceed is issued. Subject to a contrary provision in the Contract Documents, the Owner shall issue the Notice to Proceed within 10 Days of receipt of the documentation required from the Contractor under paragraph 5.1.1 of the Form of Tender. Failure by the Owner to issue the Notice to Proceed within the 10 Days shall entitle the Contractor to a claim for delay under GC 13.1.1.
	4.7	Superintendent	**Replace** GC 4.7.1 **with**: The Contractor shall employ a competent senior representative at the Place of the Work (the "Superintendent") who shall have the responsibility to ensure that the Work is performed in compliance with the Contract Documents. Unless otherwise permitted in writing by the Owner, the Superintendent shall be the person whose experience was submitted in Appendix 3 of the Tender. The Contractor shall also employ necessary assistants for the Superintendent and the Superintendent and assistants shall be in attendance at the Place of the Work while Work is being performed.
	4.11	Subcontractors	**Replace** GC 4.11.2 **with**: The Contractor shall employ only the Subcontractors listed in Appendix 5 of the Form of Tender, or others as approved in writing by the Owner, and shall not change or employ additional Subcontractors without the approval of the Owner, which approval shall not be unreasonably withheld
7.0	7.1	Changes	**Replace** GC 7.1.3 **with**: Additional work that the Owner may wish performed that does not satisfy the requirements of subparagraphs (a) and (b) of GC 7.1.1(1) is Extra Work and not a Change. Pursuant to GC 8, Extra Work may be declined by the Contractor or may, upon agreement between the parties, be undertaken as Extra Work.
9.0	9.4	Quantity Variations	**Replace** GC 9.4.1 **with**: If for any reason, including an addition or deletion under GC 7.1.1.(1) or GC 7.1.1.(2) respectively, the actual quantity of a unit price item varies by more than plus or minus the Variance Threshold Percentage from the estimated quantity for that unit price item as listed in the

			Schedule of Quantities and Prices (the "Tender Quantity") or as otherwise agreed to pursuant to these Contract Documents, then either the Owner or the Contractor may by written notice request the other party to agree to a revised unit price, considering the change in quantities. A party shall make a request for a revised unit price as soon as reasonably possible after the party concerned becomes aware of the quantity variation.
	9.4	Quantity Variations	**Replace** GC 9.4.2(2) **with**: If there is an overrun in the estimated quantity, GC 9.4.3 (2) shall apply to the overrun.
10	10.1	Force Account Costs	**Replace** GC 10.1.1(4) **with**: Force Account Work Performed by a Subcontractor shall be paid for in the lesser of: (i) the amount as provided by subparagraphs (1), (2) and (3) of this GC, plus a markup of 5%, or (ii) the actual amount the Contractor pays the Subcontractor including a markup of 10% on such actual cost to cover all overhead and profit.
12	12.2	Discovery of Hazardous Materials	**Replace** GC 12.2.2 **with**: If the Contract Administrator observes any materials at the Place of the Work that the Contract Administrator knows or suspects may be Hazardous Materials then the Contract Administrator shall immediately give written notice to the Contractor and the Contractor shall immediately stop the Work or portion of the Work as required by GC 12.2.1 (1).
13	13.9	Liquidated Damaged for Late Completion	**Replace** 13.9.1(1) **with**: as a genuine pre-estimate of the Owner's increased costs for the Contract Administrator and the Owner's own staff caused by such delay an amount of $1000.00 per day or pro rata portion for each Day that actual Substantial Performance is achieved after the Substantial Performance Milestone Date; plus
17	17.5	Disputes	**Replace** GC 17.5.2(2) **with**: If the parties have not agreed upon a Referee within 3 Days of a submission of names by one party to the other as provided by GC 17.5.2 (1), then either party may request in writing the Master Municipal Construction Documents Association to appoint the Referee. The Association will have the authority to appoint a Referee without further

			consultation with the parties and the parties shall accept the Association's appointment. If for any reason the Association fails to appoint a Referee within 5 Days of the written request then such failure shall be deemed to be an agreement between the parties to omit a review of that Dispute by a Referee and a party may at the end of the 5 Days request a Settlement Meeting and proceed with the remaining steps in the Dispute resolution process as described in this GC.
18	18.2	Supporting Documents	**Replace** GC 18.2.2 **with**: If requested in writing by the Contract Administrator the Contractor shall as a precondition to the issuance of the Payment Certificate provide a sworn declaration in a form acceptable to the Contract Administrator, that as of the date set out in the sworn declaration all amounts which have been incurred directly by the Contractor relating to the Work that are due and owing to third parties have been paid.
	18.6	Substantial Performance	**Replace** GC 18.6.3(1) **with**: a sworn declaration in a form in accordance with SGC 18.2.2; and
24	24.1	Required Insurance	**Replace** GC 24.1.1(2) **with**: Commercial General Bodily Injury and Property Damage Liability Insurance Limits: Bodily Injury and Property damage – inclusive $5,000,000 The insurance shall include Contractor's Contingent Liability and Contractual Liability of sufficient scope to include the liability assumed by the Contractor under the terms of this Contract, and Completed Operations Liability. The policy shall include the Owner and the Contract Administrator as additional insured's with a cross liability clause. Any property damage shall be for the account of the Contractor and shall not exceed $10,000.00 for any one occurrence.
	24.1	Required Insurance	**Replace** SGC 24.1.5 **with**: All policies referred to in this GC shall provide that thirty (30) days notice of cancellation will be given in writing to each insured, including the Owner, otherwise the policies to remain in full force and effect until the Work has been completed. Notwithstanding the foregoing, the Commercial General Bodily Injury and Property Damage Liability

			insurance referred to in GC 24.1.1 (2) shall remain in full force and effect from the commencement of the performance of the Work for a period of not less than twelve (12) months following Total Performance, and with respect to completed operations coverage for a period of not less than 24 months following Total Performance.
(b) PROJECT SPECIFIC			
4.2	4.2.1	Safety	**Add Clause** SGC 4.2.2 The Contractor shall be the Prime Contractor under WorkSafeBC.
4.3	4.3.4	Protection of Work, Property and the Public	**Delete and Replace Clause** 4.3.4(1) with the following Expose using hand or hydro vacuum excavation and determine conclusively the location in the field of all underground utilities and structures indicated on the Contract Documents as being at the Place of the Work.
4.3	4.3.4	Protection of Work, Property and the Public	**Delete and Replace Clause** 4.3.4(3) with the following Similarly expose using hand or hydro vacuum excavation and conclusively determine the location in the field of all underground utilities or underground structures that are reasonably apparent in an inspection of the Place of Work.
4.3	4.3.4		**Add Clause** SGC 4.3.4(4) The Contractor shall contact BC One Call prior to construction. The Contractor shall co-ordinate activities with utility owners and is responsible for protecting and supporting all utilities, including poles, during construction in a manner acceptable to the utility owner. The Contractor shall inform any utility/service provider of any planned disruption/adjustment to usual service in writing and receive written agreement of such disruption or adjustment prior to these disruptions or adjustments.
	4.3.7		**Add Clause** SGC 4.3.7. The Contractor shall maintain the uninterrupted flow of all watercourses, sewers, drains and any other utilities encountered during the work. The cost of utility relocation shall be paid by the Contractor if the relocation is for the convenience or safety of construction, and by the

			Owner if the relocation is necessary by a direct conflict between the work and the utility which in the opinion of the Contract Administrator cannot be otherwise avoided except as noted herein or on the drawings as being the Contractor's responsibility.
	4.3.8		**Add Clause** SGC 4.3.8. If instructed by the Contract Administrator, the Contractor will be responsible for arranging the relocation of utilities. The Owner will be responsible for the cost of the relocation of the utilities.
	4.3.9		**Add Clause** 4.3.9. Nothing shown or anything not shown on the drawings will relieve the Contractor of the responsibility for damage to persons or property, or delay in construction, caused by damage to or interference with existing or utilities along the route of the work to be completed under this Contract. No payment will be made for any loss or cost to the Contractor occasioned by damage to or interference with utilities.
	4.3.10		**Add Clause** SGC 4.3.10. All trees not located immediately within the excavation zone are to be protected from damage during construction, except those trees which would endanger persons or property shall be removed by the Contractor upon approval by the Owner. No trees on private property shall be damaged.
	4.3.11		**Add Clause** SGC 4.3.11 The *Contractor* shall conduct operations so as to cause the minimum obstruction and inconvenience to traffic and to places of business and residences adjacent to the *Place of Work*. No greater quantity of work shall be undertaken at any one time than can be properly conducted with due regard to the rights and interests of the public as may be determined by the *Contract Administrator.* The *Contractor* is to provide safe, satisfactory and convenient means of approach and entrance to adjoining lanes, driveways, buildings, and pedestrians wherever necessary in the opinion of the *Contract Administrator*. For this purpose the *Contractor* shall construct and maintain suitable and safe platforms, approaches, structures, bridges, diversions or other works.

			During all phases of the operation the *Contractor* shall take precautions to abate nuisance caused by mud or dust by clean- up, sweeping, sprinkling with water, or other means as necessary to accomplish results satisfactory to the *Contract Administrator*. The *Contractor* shall take care to prevent spillage on streets over which hauling is done and the *Contractor* shall immediately clean up any spillage or debris deposited on streets due to his operations.
4.6	4.6.8	Construction Schedule	**Add SGC** 4.6.8 The Construction Schedule will make adequate provision for adverse weather which may be expected from records for the area, including seasonal weather patterns.
4.6	4.6.9	Construction Schedule	**Add Clause** SGC 4.6.9 The hours of work must not extend beyond 0700 h and 1700 h, inclusive, daily. The Contractor shall schedule their work within these hours and will not be permitted to commence work earlier than 0700 h and/or work later than 1700 h, except as authorized by the *Contract Administrator*. In case the Contractor desires to work on a day which is a statutory holiday, they shall notify the Contract Administrator in writing at least four (4) days in advance of such holiday, stating those places where said work will be conducted. In case the Contractor fails to give such notice in advance of any statutory holiday, no work within the terms of the Contract shall be done on such holiday. The Owner reserves the right not to allow any work to be undertaken on Statutory Holidays The Contractor shall not schedule construction work requiring inspection in excess of a 54 hour working week. With approval of the *Contract Administrator*, extended working hours on working days will be permitted for operations, which must reasonably be completed on that date.
4.6	4.6.10	Constructio n Schedule	**Add Clause** SGC 4.6.10 The Contractor shall coordinate their work with the Owner's Operations Staff. Construction work to be done with minimal disturbance to the municipal

			utilities.
4.9	4.9.3	Materials	**Add Clause** SGC 4.9.3 1. Be responsible for storing all of the materials supplied for the *Work* either by the *Contractor* or the *Owner*, until it has been incorporated into the completed *Work*; 2. Store all materials in a matter which will prevent damage from the weather, dirt, foreign matter, vandalism and theft; 3. Arrange for and/or verify the time of delivery of all materials to be supplied by the *Contractor* or the *Owner* to ensure that delivery will coincide with the *Contractor's* work schedule. 4. Examine with the *Contract Administrator* the quantities and details of all materials supplied by the *Owner* at the time and place of delivery or those materials already at the *Place of Work*, and prepare and sign a Statement of Materials Acceptance, specifically noting and rejecting any defective material; 5. Assume responsibility, upon signing of the *Contract*, for all materials supplied by the *Owner* and already at the *Place of Work* ; 6. Replace all materials supplied by the *Contractor* or the *Owner* which are found to be stolen, missing or damaged while under his care; 7. Replace all materials found to be defective in manufacture which have been supplied by the *Contractor*
4.12	4.12.4	Test and Inspections	**Replace** "perform, or cause to be performed" with "engage a firm of testing engineers selected by the Contractor and approved by the corporation to carry out".
4.0	4.17	Licences	**Add to Clause** GC 4.17 The Contractor shall have or otherwise obtain a current

			business license in the Resort Municipality of Whistler prior to commencement of the Works
6.0	6.2.1	Coordination & Connection	**Add to Clause** GC 6.2.1 The Owner will not be liable for claims for delay caused by Utilities, BC Transit or Municipal forces for work required to be undertaken on this contract.
24	24.1	24.1.1	**Replace Clause with**: Contractor will at the Contractor's expense, carry with an insurance company or companies and under policies of insurance acceptable to and approved by Owner the following insurance with limits not less than shown in the respective items: (1) Automotive Liability Insurance (Owned and Non-Owned Units) Limits: Bodily Injury and Property Damage - inclusive each accident $3,000,000 The Contractor shall, at the Contractor's expense, throughout the term of the Contract, maintain such insurance as required under the Insurance (Motor Vehicle) Act of British Columbia. The Contractor shall provide the Owner with a Certificate of Insurance, I.C.B.C. form No. APV 47, for owned or leased vehicles as evidence of third-party motor vehicle insurance coverage. (2) Commercial General Bodily Injury and Property Damage Liability Insurance Limits: Bodily Injury and Property Damage – inclusive $5,000,000 The insurance shall include Contractor's Contingent Liability, and Contractual Liability of sufficient scope to include the liability assumed by the Contractor under the terms of this Contract, and Completed Operations Liability. The policy shall include the Owner and the Contract Administrator as additional insured with a cross liability clause. Any property damage deductible shall be for the account of the Contractor and shall not exceed $10,000.00 for any one occurrence. (3) Course of Construction Builders' Risk Insurance Coverage on an "All Risks" basis in the amount of not less than the amount of the Contract Price; subject to a

			deductible provision for the Contractor's account not exceeding $10,000.00 each loss. Coverage to include the Owner as an additional insured. (4) Insurance on Contractor supplied Equipment Equipment rented or owned by the Contractor to its full insurable value. (5) Boiler and Machinery Insurance - If Applicable. Boiler and machinery Insurance in the joint names of the Contractor and the Owner. The policy shall include as insureds all Subcontractors. The coverage shall be maintained continuously from the commencement of use or operation of the boiler and machinery objects insured by the policy and until ten calendar days after Substantial Performance.
		24.1.5	**Replace Clause with**: All policies referred to in this GC shall provide that thirty (30)days notice of cancellation will be given in writing to the Named Insured and the Owner, otherwise the policies to remain in full force and effect until the Work has been completed. Notwithstanding the foregoing, the Commercial General Bodily Injury and Property Damage Liability Insurance referred to in GC 24.1.1(2) shall remain in full force and effect from the commencement of the performance of the Work for a period of not less than twelve (12) months following Total Performance, and with respect to completed operations coverage for a period of not less than 24 months following Total Performance.
24	24.1	Insurance	**Add Clause** SGC 24.1.7: The Contractor shall ensure the following are additional named insured under this contract: HDR Corporation Resort Municipality of Whistler

END OF SUPPLEMENTARY GENERAL CONDITIONS

BETWEEN *OWNER* AND *CONTRACTOR*

This agreement made in duplicate this

_____ day of _____, 20_____.

Contract: **South Whistler Water Improvements Phase II**

(TITLE OF CONTRACT)

Reference No. **E20307**

(OWNER'S CONTRACT REFERENCE NO.)

BETWEEN:

The Resort Municipality of Whistler

(NAME OF OWNER)

(the "*Owner*")

AND:

_____

_____

_____

(NAME AND OFFICE ADDRESS OF CONTRACTOR)

(the "*Contractor*")

The *Owner* and the *Contractor* agree as follows:

The Work Start / Completion Dates

The *Contractor* will perform all *Work* and provide all labour, equipment and material and do all things strictly as required by the *Contract Documents*.

The *Contractor* will commence the *Work* in accordance with the *Notice to Proceed*. The *Contractor* will proceed with the *Work* diligently, will perform the *Work* generally in accordance with the construction schedules as required by the *Contract Documents* and

will achieve *Substantial Performance* of the *Work* on or before **October 31, 2024** subject to the provisions of the *Contract Documents* for adjustments to the *Contract Time*.

Time shall be of the essence of the *Contract.*

Contract Documents

The "*Contract Documents*" consist of the documents listed or referred to in Schedule 1, entitled "Schedule of Contract Documents", which is attached and forms a part of this Agreement, and includes any and all additional and amending documents issued in accordance with the provisions of the *Contract Documents*. All of the *Contract Documents* shall constitute the entire *Contract* between the *Owner* and the *Contractor*.

The *Contract* supersedes all prior negotiations, representations or agreements, whether written or oral, and the *Contract* may be amended only in strict accordance with the provisions of the *Contract Documents*.

Contract Price

The price for the *Work* ("*Contract Price*") shall be the sum in Canadian dollars of the following

1. **the product of the actual quantities of the items of *Work* listed in the *Schedule of Quantities and Prices* which are incorporated into or made necessary by the *Work* and the unit prices listed in the *Schedule of Quantities and Prices*; plus**
2. all lump sums, if any, as listed in the *Schedule of Quantities and Prices*, for items relating to or incorporated into the *Work*; plus
3. any adjustments, including any payments owing on account of *Changes* and agreed to *Extra Work*, approved in accordance with the provisions of the *Contract Documents.*

The *Contract Price* shall be the entire compensation owing to the *Contractor* for the *Work* and this compensation shall cover and include all profit and all costs of supervision, labour, material, equipment, overhead, financing, and all other costs and expenses whatsoever incurred in performing the *Work*.

Payment

Subject to applicable legislation and the provisions of the *Contract Documents*, the *Owner* shall make payments to the *Contractor*.

If the *Owner* fails to make payments to the *Contractor* as they become due in accordance with the terms of the *Contract Documents* then interest calculated at 2% per annum over the prime commercial lending

rate of the Royal Bank of Canada on such unpaid amounts shall also become due and payable until payment. Such interest shall be calculated and added to any unpaid amounts monthly.

Rights and Remedies

The duties and obligations imposed by the *Contract Documents* and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.

Except as specifically set out in the *Contract Documents*, no action or failure to act by the *Owner*, *Contract Administrator* or *Contractor* shall constitute a waiver of any of the parties' rights or duties afforded under the *Contract*, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach under the *Contract*.

Notices

Communications among the *Owner*, the *Contract Administrator* and the *Contractor*, including all written notices required by the *Contract Documents*, may be delivered by hand, or by email, or by fax, or by pre-paid registered mail to the addresses as set out below:

The *Owner*:

Resort Municipality of Whistler
4325 Blackcomb Way, Whistler, BC, V8E 0X5

Fax: +1 604 935-8109
Attention: Chelsey Roberts, engineers@whistler.ca

The *Contractor*:

Fax:
Attention:

The *Contract Administrator*:

Fax: _____

Attention: _____

A communication or notice that is addressed as above shall be considered to have been received

1. immediately upon delivery, if delivered by hand or by e-mail; or
2. immediately upon transmission if sent by fax and received in hard copy; or
3. after 5 *Days* from date of posting if sent by registered mail.

The *Owner* or the *Contractor* may, at any time, change its address for notice by giving written notice to the other at the address then applicable. Similarly if the *Contract Administrator* changes its address for notice then the *Owner* will give or cause to be given written notice to the *Contractor.*

The sender of a notice by fax assumes all risk that the fax is received in hard copy.

General

This *Contract* shall be construed according to the laws of British Columbia.

The *Contractor* shall not, without the express written consent of the *Owner*, assign this *Contract*, or any portion of this *Contract*.

The headings included in the *Contract Documents* are for convenience only and do not form part of this *Contract* and will not be used to interpret, define or limit the scope or intent of this *Contract* or any of the provisions of the *Contract Documents*.

A word in the *Contract Documents* in the singular includes the plural and, in each case, vice versa.

This agreement shall ensure to the benefit of and be binding upon the parties and their successors, executors, administrators and assigns.

IN WITNESS WHEREOF the parties hereto have executed this Agreement the day and year first written above.

Contractor:

_____
(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

_____
(AUTHORIZED SIGNATORY)

_____
(AUTHORIZED SIGNATORY)

Owner:

Resort Municipality of Whistler

(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

(AUTHORIZED SIGNATORY)

(AUTHORIZED SIGNATORY)

SCHEDULE OF CONTRACT DOCUMENTS	The following is an exact and complete list of the *Contract Documents*, as referred to in Article 2.1 of the Agreement.	
	***NOTE*:** The documents noted with "*" are contained in the "Master Municipal Construction Documents - General Conditions, Specifications and Standard Detail Drawings", edition dated 2009. All sections of this publication are included in the *Contract Documents*.	
		Agreement, including all Schedules;
		Supplementary General Conditions;
		General Conditions*;
		Supplementary Specifications;
		Specifications*;
		Supplementary Standard Detail Drawings (if any, insert title and edition date);
		Standard Detail Drawings*;
		Executed Form of Tender, including all Appendices;
		Contract Documents listed in Schedule 2 to the Agreement –"List of *Contract Documents*";
		Instructions To Tenderers - Part I;
		Instructions to Tenderers - Part II*;
		The following Addenda:

LIST OF CONTRACT DOCUMENTS

TITLE	DRAWING NO.	DATE	REVISION NO.	REVISION DATE
RMOW South Whistler Water Supply Phase 2 Drawings	G001 to Y003 inclusive of 130 drawings		1	Sept 17, 2023

REFERENCE DOCUMENT	DOCUMENT #	DATE	REVISION NO.	REVISION DATE
Preliminary Geotechnical Report, Proposed South Whistler Booster Pump, Water Treatment Facility and Water Supply Project, Resort Municipality of Whistler, BC	1956	10/02/2023	1	10/02/2023
SWWS Phase I Civil Drawings	RMOW South Whistler Water Supply Phase 1	12/05/2023	1	12/05/2023

SUPPLEMENTAL SPECIFICATIONS

Resort Municipality of Whistler

South Whistler Water Improvements Phase II

Construction Documents
Project Manual

Draft for Review

September. 21, 2023

RMOW Project No. E20307

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SECTION 01 11 00
SUMMARY OF WORK

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Location and description of Work.

.2 Others retained by the Owner for the Project.

.3 Work by Owner.

.4 Sequence and Progress of Work.

.5 Contractor's use of the Site.

.2 Related Requirements:

.1 Include, but are not limited to, the following:

.1 Section 01 14 16 - Coordination with Owner's Operations.

.2 Section 01 14 19 - Use of Site

.3 Section 01 71 33 - Protection of the Work and Property.

1.2 LOCATION AND DESCRIPTION OF WORK

.1 The Work is located in the Resort Municipality of Whistler primarily at 1135 Cheakamus Lake Road with secondary activities in the interpretative forest parking lot and along Lynman Road.

.2 The Project includes constructing the Work broadly described below, in accordance with the Contract Documents, with all related appurtenances. Work shown on the Drawings, or indicated in the Specifications, or indicated elsewhere in the Contract Documents is part of the Work, regardless of whether indicated below. The Work includes, but is not limited to the following:

.1 Construction of a new potable water booster pump station and caustic soda chemical dosing facility to adjust pH in the drinking water supply system, including:

.1 Concrete foundations

.2 Masonry block building

.3 Pre-Engineered trusses

.4 Building envelope

.2 Site development including:

.1 Excavation and site works

.2 Watermain tie-ins

.3 Drainage systems

.4 Paving
.5 Buried FRP tank
.6 Testing and flushing of new and existing watermains

.3 Process mechanical including:
.1 Stainless steel piping
.2 2 x 100hp vertical turbine pumps
.3 30 hp groundwater pump
.4 Pressure reducing and relief valves
.5 Peristaltic metering pumps
.6 Water softeners
.7 Chemical process piping, valves and appurtenances
.8 2 x 12,000 L insulated FRP chemical tanks

.4 Electrical work including
.1 MCC including VFDs, Power Distribution, breakers, MCP, PQM, SPD
.2 Building power distribution including conduit, cable trays and conductors
.3 Building lighting

.5 Instrumentation and controls
.1 Instruments including flow meters, pressure elements, temperature elements, pH analyzers
.2 Fibre optic installed in existing conduit
.3 PLC controls, I/O cards and remote I/O

.3 Hazardous Environmental Conditions:
.1 Portions of the work will occur within existing RMOW potable water pumping stations which contain sodium hypochlorite.
.2 Portions of the work will require commissioning with 50% caustic soda solution.

1.3 OTHERS RETAINED BY THE OWNER FOR THE PROJECT

.1 Engineer:
.1 Engineer in terms of the Agreement is HDR Corporation at #500 - 1500 West Georgia St. Vancouver, BC.
.2 Engineer's responsibilities for the Project, relative to the Contractor, are indicated throughout the Contract Documents.
.3 The Engineer will provide services for the Contract as required and when required.

1.4 WORK BY OWNER

.1 Owner will perform the following in connection with the Work:

.1 Operate all existing valves, MCC shutdowns, pumps, equipment, and appurtenances that will affect the Owner's operations or facility processes unless otherwise specified or indicated.

.2 Owner will perform facility PLC programming and SCADA screen updates associated with the new system. The work will be completed for the Commissioning and Demonstration Periods.

.3 Provide programming support during the Commissioning and Demonstration periods.

1.5 SEQUENCE AND PROGRESS OF WORK

.1 Requirements for sequencing and coordinating with the Owner's operations, including maintenance of facility operations during construction, and requirements for tie-ins and shutdowns, are in Section 01 14 16 - Coordination with Owner's Operations.

1.6 CONTRACTOR'S USE OF THE SITE

.1 Requirements and restrictions are presented in Section 01 14 19- Use of Site.

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 14 16
COORDINATION WITH OWNER'S OPERATIONS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Requirements for coordinating with Owner's operations during the Project.

.2 Requirements for tie-ins and shutdowns necessary to complete the Work without impact on Owner's operations except as allowed in this Specifications section.

.2 Scope:

.1 Contractor shall provide all labour, materials, equipment, tools, and incidentals shown, specified, and required to coordinate with Owner's operations during the Work in accordance with this Specifications section.

.2 Except for shutdowns specified in this Specifications section, perform the Work such that Owner's facilities remain in continuous, satisfactory operation during the Project. Schedule and perform the Work such that the Work does not: impede Owner's production or processes, create potential hazards to operating equipment and personnel, reduce the quality of the facility's products or other nuisances, does not affect the public health, safety, welfare, and convenience, and does not adversely affect the environment resulting in violation of Laws or Regulations.

.3 Work not specifically addressed in this Specifications section or in referenced sections may, in general, be performed, to be completed within the Contract Times, at any time during regular working hours in accordance with the Contract Documents, subject to the requirements in this section.

.3 Related Requirements: Include but are not necessarily limited to:

.1 Section 01 11 00 - Summary of Work.

.2 Section 01 73 29 - Cutting and Patching.

.3 Section 01 75 00 - Checkout and Startup Procedures.

1.2 REFERENCES

.1 Terminology:

.1 Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this Specifications section have the meaning indicated below:

.1 The term "Owner" is used throughout this section. When the facility is operated or managed by an entity other than Owner, references in this section to "Owner" as the operator or manager of the facility will be interpreted as referring to the facility manager.

.2 A "shutdown" is when a portion of the normal operation of Owner's facility, whether equipment, systems, conduit (including piping and ducting), has to be temporarily suspended or taken out of service to perform the Work.

.3 A "tie-in" is a connection of new Work to existing facilities, including connecting to existing conduits (including piping and ducting), electrical systems, structural elements, process/mechanical elements, and other physical connections. Some tie-ins may require that the tie-in be made without an associated shutdown.

.4 The following watermains are defined as follows.

Name	Description	Start/finish	Status	Scope
WW	Well Water Supply	W212 to P279	Caped at Lyman Rd Tied into W217 w/m	Tie into WVS at Lyman Road Modify tie-in at W217/P279
WVS	Whistler Village Supply	P279 to Gondola Reservoir	Tied into W212 Continuous to Gondola	Disconnect at Lynman Road Tie-in to P291
WRR	Whistler (Cheakamus) Reservoir Return	P279 to Cheakamus Reservoir	Existing	Replace elbow with Tee to service Function Junction
WRS	Whistler (Cheakamus) Reservoir Supply	Cheakamus Reservoir to Distribution	Existing	Remove PRV and replace with elbow

.2 Reference Figures:

.1 Reference figures are attached to this specification and are intended to provide information only.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Review construction procedures under other Specifications sections and coordinate Work that will be performed with or before the Work indicated in this Section.

.2 Sequencing and Scheduling:

.1 Refer to this Specifications sections articles on sequencing, tie-ins, and shutdowns.

1.4 SUBMITTALS

.1 Informational Submittals: Submit the following:

.1 Shutdown Planning Submittal:

.1 For each shutdown, submit an inventory of labour, materials, and equipment required to perform the shutdown and tie-in tasks, an estimate of time required to accomplish the complete shutdown including time for Owner to take down and start up existing equipment, systems, or conduits, and written description of steps required to complete the Work associated with the shutdown.

.2 Furnish submittal to Engineer not less than 30 days prior to proposed shutdown start date. Do not start shutdown until obtaining Engineer's acceptance of shutdown planning Submittal.

.2 Shutdown Notification:

.1 After Engineer's acceptance of shutdown planning Submittal and prior to starting the shutdown, submit written notification to Owner and Engineer of date and time each shutdown is to start. Submit notification not less than 72 hours in advance of each shutdown.

1.5 GENERAL CONSTRAINTS

.1 Indicated in the Contract Documents are the sequence and shutdown durations, where applicable, for Owner's equipment, systems, and conduits (including piping and ducting) that are to be taken out of service temporarily for the Work. New materials and equipment may be used by Owner after the specified field quality control activities are successfully completed and the materials or equipment are substantially complete in accordance with the Contract Documents.

.2 The following constraints apply to coordination with Owner's operations:

.1 Operational Access: Owner's personnel shall have access to equipment and areas of the facility that remain in operation.

.2 . Equipment and systems shall not be placed into operation on Friday, Saturday, Sunday, or holidays without prior approval of Owner, unless specifically indicated otherwise in the Contract Documents.

.3 Dead End Valves or Conduits:

.1 Provide blind flanges or valve at temporary and permanent terminuses of conduits, including piping and ducting.

.2 Blind flanges shall be suitable for the service and braced and blocked, as required, or otherwise restrained as necessary or as required by Engineer.

.3 Temporary valves shall be suitable for their associated service. Where valve is provided at permanent terminus of conduit, including piping, also provide on downstream side of valve a blind flange with drain/flushing connection.

.4 Owner will assist Contractor in dewatering watermains, and other work areas to be dewatered for shutdowns. Maintain clean, dry work area by pumping and properly disposing of fluid and other material that accumulates in work areas.

.5 Draining and Cleaning of Watermains, Tanks, and Basins:

.1 Unless otherwise shown or indicated in the Contract Documents, Contractor shall dewater, basins, watermains at beginning of each shutdown.

.2 If drainage point is not available on the watermain to be drained, provide a wet tap using tapping saddle and valve or other method approved by Engineer. Uncontrolled spillage of contents of watermains is not allowed.

.3 Spillage shall be brought to Engineer's attention immediately, both orally and in writing, and reported in accordance with Laws and Regulations.

1.6 SEQUENCE OF WORK

.1 Perform the Work in the indicated sequence. Work may be accelerated from a later stage to an earlier stage if Owner's operations are not adversely affected by proposed substitute sequence, with Engineer's approval. Stages specified in this article are sequence-dependent.

.2 Stage 1 (completed under previous Contract)

.1 WRR from W212 to Interpretive Forest Parking Lot (near existing P284) is installed, tested and capped

.2 WVS from outside P279 to Interpretive Forest Parking Loat (near existing P284) is installed, tested and capped.

.3 Stage 2.1:

.1 Contractor to complete construction of P291 and all civil and mechanical piping, including pressure testing, disinfection and tie-in swabbing.

.2 Remove piping from W212 per Sheet D008, except existing tie-in from WVS to PRV (BOM Item #18)

.3 Install piping in W212 per Sheet D009 up to end of BOM Spool #49 and install temporary cap, including small diameter piping to small PRV.

.4 Initial commissioning of new PRV in P291, FCV-007A

.4 Stage 2.2 – **Temporary Shutdown of PRV284 Supply to Cheakamus Zone**

.1 Isolate and drain WVS using existing gate valve at branch line near Lyman Road

.2 Remove P284 and tie existing WVS in Interpretive Parking Lot to new WVS constructed in Stage 1.

.3 Open valve on WVS near Lyman Road.

.4 Refill WVS using W212 and flush points in P291.

.5 Final commission new PRV in P291, FCV-007A.

.5 Stage 2.3A – **Temporary Shutdown of Cheakamus Reservoir**

.1 Confirm operation of new PRV in P291, FCV-007A servicing Cheakamus subdivision.

.2 Confirm Gondola Reservoir volume and supply.

.3 Isolate Cheakamus Reservoir using existing gate valve on branch line from reservoir, near interpretive forest parking lot, and valve on Cheakamus Road near WWTP driveway.

.4 Depressurize existing line and drain.

.5 Remove elbow and replace with tee per drawing C012.

.6 Open WRR valves and reservoir supply

.6 Stage 2.3B

.1 Isolate small PRV in W212, supply zone from large PRV.

.2 Install new connection from Spool #49 on drawing D009 to small PRV.

.3 Open small PRV and confirm set-points.

.4 Isolate large PRV in W212, supply zone from small PRV.

.5 Remove elbow in W212 (#18) and replace temporary cap on spool #49 and install elbow and tie-in WRR to existing PRV.

.6 Open large PRV and confirm set-points.

.7 Stage 2.4 – **Multi-Day Shutdown of W212 Supply**

.1 Confirm pre-testing of P291 pumps P100A and P200A.

.2 Isolate and drain WVS from W212 to isolation valves on WVS prior to Highway 99.

.3 Expose existing Tee on WVS at Lyman Road, install cap existing tee on branch from W212 per drawing C014

.4 Open gate valves on WVS and fill piping.

.5 Final commissioning of P100A and P200A.

.6 Supply Gondola and Cheakamus Reservoirs from only W218.

.8 Stage 2.5: - **Multi-Day Shutdown of W212 Supply**

.1 Isolate W212 pump and drain existing pump discharge line from W212 to now disconnected pipe at end of Lyman Road (formerly WVS line).

.2 Tie-existing WW line at Lynman Road to existing line from W212 (formerly WVS) per drawing C014.

.3 Replace well pump with new low head pump

.4 Commission new well pump.

.5 Supply P279 from W212 and W218.

1.7 TIE-INS

.1 Table 01 14 16-A in this Specifications section lists connections by Contractor to existing facilities. Table 01 14 16-A may not indicate all tie-ins required for the Work; Contractor shall perform tie-ins necessary and required to complete the Work as shown or indicated in the Contract Documents, regardless of whether tie-in is indicated in Table 01 14 16-A. For tie-ins not indicated in Table 01 14 16-A, obtain requirements for tie-ins from Engineer by requesting an interpretation or clarification.

1.8 SHUTDOWNS

.1 Shutdowns shall be in accordance with Table 01 14 16-B of this Specifications section. Work requiring service interruptions for tie-ins shall be performed during scheduled shutdowns.

.2 Work that may interrupt normal operations shall be accomplished at times convenient to Owner unless otherwise indicated in the Contract Documents.

.3 If Contractor's operations cause an unscheduled interruption of Owner's operations, immediately re-establish satisfactory operation for Owner.

.4 Fines and Penalties Imposed by Authorities Having Jurisdiction:

.1 Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of Owner's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by Contractor if, in Engineer's opinion, Contractor did not comply with requirements of the Contract Documents, or was negligent in the Work, or did not exercise proper precautions in performing the Work and complying with applicable permits, Laws, and Regulations.

.2 Owner or Engineer may deduct as set-offs such amounts from payments due Contractor.

.5 Temporary, short-term shutdowns of smaller conduits (including piping and ducting), equipment, and systems may not be included in Table 01 14 16-B. Coordinate requirements for such shutdowns with Engineer and Owner. Where necessary, obtain Engineer's interpretation or clarification before proceeding.

2. PRODUCTS - (NOT USED)

3. EXECUTION

3.1 SUBSTITUTE PROCEDURES

.1 Proposal of Substitute Sequencing, Shutdowns, and Tie-Ins:

.1 As a substitute to the procedures indicated in this Specifications section, Contractor may propose providing additional temporary facilities that can eliminate or mitigate a constraint without additional cost to Owner, provided such additional temporary facilities: do not present hazards to the public, personnel, structures, and equipment; that such additional temporary facilities do not adversely affect Owner's ability to comply with Laws and Regulations, permits, and operating requirements; that such temporary facilities do not generate or foster the generation of odors and other nuisances; and that requirements of the Contract Documents are fulfilled.

.2 Engineer will consider proposals for substitute procedures after the Effective Date of the Contract. All Bids shall be based on the requirements of the Contract Documents, including this section.

.3 Substitution Requests:

.1 When proposing a substitute procedure for a tie-in or shutdown or other requirements of this section, comply with the requirements of the General Conditions and Supplementary Conditions (regarding substitutes) and Section 01 25 00 - Substitution Procedures.

.2 When deviation from specified sequence or procedures is proposed, Contractor's proposal shall explain in detail the proposed sequence and procedures and associated effects, including evidence that Owner's operations will not be adversely affected, to an extent greater than originally contemplated in the Contract Documents, by proposed substitution. List benefits of proposed substitution, including benefits to Progress Schedule.

3.2 GENERAL PROVISIONS FOR COORDINATING WITH OWNER'S OPERATIONS

.1 When possible, combine multiple tie-ins into a single shutdown to reduce impacts on Owner's operations and processes.

.2 Operation of Existing Systems and Equipment during the Work:

.1 Do not shut off or disconnect existing operating systems or equipment, unless accepted by Engineer in writing.

.2 Operation of existing systems and equipment will be by Owner unless otherwise specified or indicated.

.3 Where necessary for the Work, Contractor shall seal or bulkhead Owner-operated gates and valves to prevent leakage that may affect the Work, Owner's operations, or both.

.4 Provide temporary watertight plugs, bulkheads, and line stops as necessary and as required. After completing the Work, remove seals, plugs, bulkhead, and line stops to satisfaction of Engineer.

.3 Bypassing:

.1 Diversion of flows between watermains is not allowed.

.4 Performing the Work of this section constitutes Contractor's approval of underlying work and field conditions prevailing at the time of the Work.

3.3 PREPARATION

.1 Shutdowns - General Preparation:

.1 Coordinate shutdowns with Owner and Engineer.

.2 Submit shutdown planning Submittals and shutdown notification Submittals in accordance with this Specifications section's "Submittals" Article.

.3 Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, materials, equipment, spare parts, both temporary and permanent, necessary to successfully perform the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to commencing the associated shutdown. Demonstrate to Engineer's satisfaction that Contractor has complied with such requirements before commencing the shutdown.

.4 Engineer shall have no duty to Contractor to advise Contractor of inadequate preparations by Contractor; Contractor is solely responsible for the means, methods, procedures, techniques, and sequences of construction.

.2 Shutdowns of Electrical Systems:

.1 Comply with Laws and Regulations, including the Canadian Electrical Code.

.2 Contractor shall lock out and tag circuit breakers and switches operated by Owner and shall verify that affected cables and wires are de-energized to ground potential before starting other Work associated with the shutdown.

.3 Upon completion of shutdown Work, remove the locks and tags and advise Engineer that facilities are available for use.

.3 Completion of P291 and preliminary configuration of new pumps and PRV.

3.4 ATTACHMENTS

.1 The following, bound after this Specifications Section's "End of Section" designation, are part of this Specifications Section:

.1 Tables:

.1 Table 01 14 16-A, Schedule of Tie-ins

.2 Table 01 14 16-B, Schedule of Shutdowns

END OF SECTION

Table 01 14 16-A
Schedule of Tie-Ins

e-In o.	Stage	Existing (Connecting) Line Size & Service	Tie-In Building/Location	Construction Stage	Remarks
1	Stage 2.1	N/A	Inside W212	Concurrent with P291 Construction	Preparation work for Sta 2.2
2	Stage 2.2	400mm PC350 TR Flex 400mm PC350 Retrained	Interpretive Forest Parking Lot	Post P291 Construction	
3	Stage 2.3A	250mm PC350 DI (Restrained) 350 PC350 DI (Restrained)	Interpretive Forest Parking Lot	Post P291 Construction	350mm/250mm reduc required on new tee
4	Stage 2.3B	75mm Steel 150mm Steel	Inside W212	Post P291 Construction	Sequenced installation new piping to existing Function Junction PR
5	Stage 2.4	300/400mm PC350 DI Unrestrained	Gravel lot at end of Lyman Road	Post P291 Construction	Existing w/m is 300m along highway and 400 to Interpretive Parking
6	Stage 2.5	250mm PC350 DI Restrained to 300mm PC350 DI unrestrained	Gravel lot at end of Lyman Road	Post P291 Construction	Existing w/m is 300mm termination and 250m across highway

Table 01 14 16-B
Schedule of Shutdowns

hut-own No.	Equipment and Service Lines Out-of-Service During Shutdown	Equipment In Operation During Shutdown	Tie-In Nos.	Maximum Duration	Calenda Period
A	PRV284 Supply to Cheakamus Distribution System (Stage 2.2)	No supply from Gondola Reservoir to Cheakamus Water System	1	8hrs	N/A
B	Cheakamus Reservoir (Stage 2.3A)	No supply from Cheakamus Reservoir to Cheakamus Water System (supply via Gondola and new PRV)	1	8hrs	N/A
C	W212 to Gondola Reservoir (Stage 2.4 and Stage 2.5)	No supply from W212 to Gondola or Whistler Water System	1	14 days	March-Ap 2025

STAGE 2.1

TO GONDOLA
RESERVOIR R228

TO CHEAKAMUS
RESERVOIR R

P284

PRV
W212-2
W212-1

CHEAKAMUS ROAD

HWY 99

W217

P279

EX. UNUSED STUB

W212-2
DECOMMISSIONED

TW06-2
DECOMMISSIONED

WHISTLER VILLAGE SUPPLY (WVS)
WHISTLER RESERVOIR RETURN (WRR)
WHISTLER RESERVOIR SUPPLY (WRS)
WELL WATER (WW)

ISSUE	DATE	DESCRIPTION
	2021-10-25	

PROJECT MANAGER	W. BAYLESS
CIVIL	WB
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	10299470

REVIEW PURPOSES ONLY
NOT FOR CONSTRUCTION

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY

2021

01 14 16A
COORDINATION WITH OWNER'S OPERATOINS TIE-IN SEQUENCE

0 25m 50m

FILENAME	10299470-C01-100-SK101.dwg
SCALE	1:1,000

SHEET
01 14 16A - 1

STAGE 2.2

TO GONDOLA RESERVOIR R228

TO CHEAKAMUS RESERVOIR R...

P284

PRV

W212-2

W212-1

CHEAKAMUS ROAD

HWY 99

W217

P279

ISOLATE AT EX. GATE VALVE

WRR 300mm

WVS 300mm

300mm

250mm WW

WVS 200mm

300mm WRR

250mm

WVS 400mm

250mm

WRS 250mm

WRR 350mm

350mm 400mm WW

WVS 400mm

WRS

WRR

WVS

1. WVS TIE-IN TO P291
2. WRR TIE-IN TO P291
3. COMMISSIONING P284

P284

WHISTLER VILLAGE SUPPLY (WVS)
WHISTLER RESERVOIR RETURN (WRR)
WHISTLER RESERVOIR SUPPLY (WRS)
WELL WATER (WW)

ISSUE	DATE	DESCRIPTION
	2021-10-25	

PROJECT MANAGER	W. BAYLESS
CIVIL	WB
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	10299470

REVIEW PURPOSES ONLY
NOT FOR CONSTRUCTION

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY

2021

01 14 16A
COORDINATION WITH OWNER'S OPERATOINS TIE-IN SEQUENCE

0 25m 50m

FILENAME	10299470-C01-100-SK101.dwg
SCALE	1:1,000

SHEET
01 14 16A - 2

STAGE 2.3

TO GONDOLA
RESERVOIR R228

TO CHEAKAMUS
RESERVOIR R

1. WRR FROM RESERVOIR OFF-LINE

WRS
WRR
250mm
350mm
250mm
WVS 400mm
250mm
HOT TAP
LOCATION
350mm
400mm
WW
WVS 400mm

P284

PRV
W212-2
W212-1

WRR
300mm
WVS
300mm
400mm
250mm
WW

CHEAKAMUS ROAD

HWY 99

W217
P279

WVS 200mm
300mm
WRR

WRS
WRR
WVS
P284

WHISTLER VILLAGE SUPPLY (WVS)
WHISTLER RESERVOIR RETURN (WRR)
WHISTLER RESERVOIR SUPPLY (WRS)
WELL WATER (WW)

ISSUE	DATE	DESCRIPTION
	2021-10-25	

PROJECT MANAGER	W. BAYLESS
CIVIL	WB
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	10299470

REVIEW PURPOSES ONLY
NOT FOR CONSTRUCTION

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY

2021

01 14 16A
COORDINATION WITH OWNER'S OPERATOINS TIE-IN SEQUENCE

0 25m 50m

FILENAME 10299470-C01-100-SK101.dwg
SCALE 1:1,000

SHEET
01 14 16A - 3

STAGE 2.4

TO GONDOLA
RESERVOIR R228

TO CHEAKAMUS
RESERVOIR R

P284

PRV
W212-2
W212-1

CHEAKAMUS ROAD

HWY 99

W217

P279

P284

ISOLATE AT EX.
GATE VALVES

ISOLATE AT EX.
GATE VALVES

WRS
WRR
WVS
WW
250mm
300mm
350mm
400mm

WHISTLER VILLAGE SUPPLY (WVS)
WHISTLER RESERVOIR RETURN (WRR)
WHISTLER RESERVOIR SUPPLY (WRS)
WELL WATER (WW)

ISSUE	DATE	DESCRIPTION
	2021-10-25	

PROJECT MANAGER	W. BAYLESS
CIVIL	WB
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	10299470

REVIEW PURPOSES ONLY
NOT FOR CONSTRUCTION

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY

2021

01 14 16A
COORDINATION WITH OWNER'S OPERATOINS TIE-IN SEQUENCE

0 25m 50m

FILENAME	10299470-C01-100-SK101.dwg
SCALE	1:1,000
SHEET	01 14 16A - 4

PROJECT MANAGER	W. BAYLESS
CIVIL	WB
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	10299470

ISSUE	DATE	DESCRIPTION
	2021-10-25	

REVIEW PURPOSES ONLY
NOT FOR CONSTRUCTION

WHISTLER

Whistler, BC

SOUTH WHISTLER WATER SUPPLY

2021

01 14 16A
COORDINATION WITH OWNER'S OPERATOINS TIE-IN SEQUENCE

0 25m 50m

FILENAME 10299470-C01-100-SK101.dwg

SCALE 1:1,000

SHEET 01 14 16A - 5

SECTION 01 14 19
USE OF SITE

1. GENERAL

1.1 SUMMARY

.1 Section Includes: Restrictions on Contractor's use of the Site and premises.

.2 Restrictions on use of existing buildings and structures, including:

.1 Permanent utilities

.2 Existing equipment.

.3 Access to existing buildings managed by the RMOW is restricted to 7am to 4pm unless other arrangements are made with the RMOW.

.2 Scope:

.1 Contractor shall provide all labour, materials, equipment, tools, and incidentals shown, specified, and required to comply with restrictions on Contractor's use of the Site and other areas.

.2 Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions, regarding the Contractor's use of the Site and other areas.

1.2 SUBMITTALS

.1 Action Submittals: Submit the following:

.1 Shop Drawings:

.1 Site plan showing the proposed location of staging and laydown areas, temporary storage and other areas Contractor proposes to occupy.

1.3 USE OF PREMISES

.1 Limit use of premises at the Site to work areas shown or indicated on the Drawings or as specified in this Section. Do not disturb portions of the Site beyond areas of the Work.

.1 Limits:

.1 Confine construction operations to the agreed areas

.2 Storage of materials and equipment, and locations of temporary facilities to be arranged with the Owner:

.1 Confine storage of materials and equipment to the agreed area.

.2 Contractor's gang boxes and storage containers for tools in active use in the Work may be kept in reasonable quantity in the work areas as long as such items do not obstruct access to the facilities by Owner or occupants.

.2 Prohibitions:

.1 Do not use the Site for the following:

.1 Conducting Contractor's business not related to the Project or other work for Owner.

.2 Overnight lodging or other, non-work use of the Site by workers or others for whom Contractor is responsible, whether housed in recreational vehicles, other vehicles, tents, quarters in field offices or Contractor-furnished temporary structures, or in work areas, is unacceptable.

.3 Refer to Section 01 57 33 - Temporary Security, for other prohibited activities.

.2 Use of Existing Buildings and Structures: Maintain existing buildings and structures in weather-tight condition throughout construction unless otherwise indicated in the Contract Documents. Protect buildings, structures, and occupants during construction.

.1 Use of Existing Utilities, Sanitary Facilities, and First-aid Facilities:

.1 Do not use permanent telephone, Internet, or other communications utilities and facilities at the Site, regardless of whether such services and facilities were provided under the Project or existed prior to the Project, except in cases of emergency.

.2 Do not use Owner's or occupants' first-aid facilities, except in cases of a medical emergency. Promptly replenish used items and supplies with items identical to those used.

.3 Promptly repair damage to premises, including existing structures, finishes, equipment, and other features, caused by construction operations. Upon completion of the Work, restore premises to specified condition; if the condition is not specified, restore to pre-construction condition.

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 22 00
MEASUREMENT AND PAYMENT

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements applicable to all bid/pay items.

.2 General provisions on lump sums.

.3 Listing of the various bid/pay items in the Project, together with criteria for measuring Unit Price Work for payment.

1.2 REQUIREMENTS APPLICABLE TO ALL BID/PAY ITEMS

.1 In this Section and elsewhere in the Contract Documents, the terms “bid item”, “pay item”, “bid/pay item”, “Item” followed by a number designation, “this item”, and the like all have the same meaning, and refer to one or more specific elements of the Contract, established for pricing and payment, as indicated in the Tender Form, which becomes part of the Contract signed by the parties.

.2 Drawing and Specifications are to be interpreted together and where work is required to complete the installation, but not shown on the drawings or in the specifications, it shall be included in the payment item most closely associated with the work.

.3 This Article applies to all bid/pay items in the Contract.

.4 Prices – General:

.1 The bid/pay items listed starting with Article 1.5 of this Section refer to and are the same bid items listed in the Tender Form and included in the Contract and constitute all bid/pay items for the Work at the time the Contract was signed by the parties.

.2 All Lump Sum items shall be inclusive of all labour, equipment, and materials required to complete the Work in accordance with the Contract Documents. Include costs for work, materials, supplies, permits and equipment not expressly stated in the Contract Documents but implied or required in order to complete the Work.

.3 Price Escalation:

.1 Unless expressly indicated otherwise in the Contract Documents, the Owner is not obligated to change the stipulated prices (including lump sums, unit prices, and allowances) that are all or part of the Contract Price because of escalation of costs when there is no corresponding change in the Contract Schedule.

.2 Changes in the Contract Schedule do not necessarily entitle Contractor to a change in Contract Price due to escalation.

.4 Each lump sum in the Contract shall include an amount considered by Contractor as sufficient for all overhead and profit for each separately identified bid/pay item.

.5 Contract Price, Payment Procedures, and Related Matters:

.1 Contract Price: The Contract Price, as apportioned among bid/pay items in the Contract, may be modified by Change Order.

.2 Payments to Contractor: Refer to the General Conditions (as may be modified by the Supplementary Conditions), the Agreement (including provisions on retainage, if any), among other applicable Contract Documents.

.3 Procedures for Changes in Contract Price: Refer to the General Conditions (as may be modified by the Supplementary Conditions).

.4 Alternates: The scope and limits of alternates, when contemplated for or included in the Contract, may be addressed, in whole or in part, in Section 01 25 00 – Substitution Procedures.

.5 Provisional Items: Provisional Work is included in the Schedule of Quantities and Prices and will be undertaken and included in the Contract at the election of the Owner. No claim by the Contractor will be entertained if the Owner elects not to proceed with one more of the provisional items or variations to the pricing indicated in the Tender Form should the Owner elect to proceed with one or more of the Provisional Items.

.6 Defective Work is not eligible for payment.

1.3 GENERAL PROVISIONS ON UNIT PRICES AND QUANTITIES

NOT USED

1.4 GENERAL PROVISIONS ON LUMP SUM ITEMS

.1 Progress payments for Work paid on a lump sum basis will be based on the Engineer's estimate of the Work (in accordance with the Contract Documents) performed through the end of the associated pay period, based on the Schedule of Quantities and Prices.

.2 At its sole discretion, the Engineer may correct amounts of lump sum Work included in prior payment requests based on improved data or information available to the Engineer, or Engineer's knowledge or reasonable belief that Work is incomplete or defective.

1.5 BID/PAY ITEMS – GENERAL CONTRACT

.1 Item 1- General Requirements (Division 01):

.1 This includes all costs for the

.1 Provision of bonds/security, and insurance,

.2 Mobilization/demobilization,

.3 Temporary facilities,

.4 Administration,

.5 Survey and layout, and

.6 All other general requirements.

.2 Payment for this item will be made on the following basis:

.1 Twenty five (25%) of the lump sum price upon mobilization and active construction;

.2 Twenty five (25%) of the lump sum price upon clean-up, restoration, demobilization, and receipt of final as-constructed drawings, O&M manuals, and completed commissioning forms;

.3 Fifty (50%) of the lump sum price paid in equal installments over the duration of the Contract based on the approved construction schedule.

.2 Item 2 – Demolition (Division 02)

.1 This item includes:

.1 Removal of trees,

.2 Removal of asphalt,

.3 Removal of buried pipe work, and

.4 Off-site disposal of demolition material not stated to be retained for use by the Contractor or the Owner.

.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.3 Item 3 – Concrete and Masonry (Division 03 & 04)

.1 Concrete work including:

.1 Foundation concrete formwork, concrete, rebar, appurtenances and finished

.2 Concrete ring beams

.3 Concrete containment walls and tank plinths

.4 Concrete equipment pads

.2 Masonry block wall construction

.1 Blockwork, bond beams, pointing and reinforcing

.3 Pre-engineered wood trusses

.4 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.4 Item 4 – Metals (Division 05)

.1 Miscellaneous Metals including:

.1 Metal anchoring /support systems

.2 Metal staircase

.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.5 Item 5 – Rough Carpentry (Division 06)

.1 Rough carpentry

.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.6 Item 6 – Thermal and Moisture Protection (Division 07)

.1 Wall envelope work including:

.1 Non-permeable air/vapour barrier
.2 Thermal isolation
.3 Insulation
.4 Wall cladding

.2 Roof systems
.1 Non-permeable air/vapour barrier
.2 Gyprock
.3 Insulation
.4 Sheathing
.5 Roofing underlay and metal roofing systems
.6 Snow retention systems

.3 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.7 Item 7 – Openings and Finishes (Division 08 & 09)
.1 Doors and hardware including:
.1 Metal doors and associated hardware
.2 Folding exterior doors and associated hardware

.2 Epoxy floor finishes
.1 Floors and containment sumps

.3 Painting including:
.1 Doors, trim, walls, ceilings

.4 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.8 Item 8 – Specialties (Division 10)
.1 Portable fire extinguishers
.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.9 Item 9- Equipment (Division 11)
.1 Supply and Installation of Chemical Storage Tanks, including
.1 Supply and placement of FRP tanks
.2 Tank heat tracing
.3 Tank insulation

.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.10 Item 10 – Process Interconnections and Controls (Division 40)
.1 Process mechanical piping work including:
.1 Stainless steel process piping

.2 Air piping
.3 Potable water valves
.4 Actuators
.5 Pipe supports

.2 Supply and installation of chemical process piping including:
.1 Fused Halar plastic piping and socket welded PVC process piping
.2 Chemical valves
.3 Chemical circulation pump
.4 Heat tracing and insulation of pipe systems

.3 Softened water chemical piping including injection appurtenances

.4 Water softener, brine tank, and interconnecting piping

.5 Process piping demolition and modification at P279 pump station

.6 Process piping demolition and modification as W212 control building

.7 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.11 Item 11 – Process Gas and Liquid Handling (Division 43)
.1 Supply and installation of vertical turbine booster pumps
.2 Removal, supply and installation of W212 submersible well pump
.3 Air compressor
.4 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.12 Item 12 – Plumbing systems (Division 22)
.1 Installation of plumbing systems including:
.1 Hot water heating system
.2 Domestic plumbing
.3 Sanitary drainage
.4 Venting systems
.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.13 Item 13 - Electrical Systems (Division 26)
.1 Installation of new electrical MCC equipment, including:
.1 MCC cabinets
.2 VFD drives, filters and appurtenances
.3 PQM, SPD and appurtenances
.4 Breakers, panel boards, pull sections
.5 Installation
.2 Lighting systems

.3 Interior power distribution including:
  .1 Conductors
  .2 Cable trays
  .3 Conduit
.4 Exterior power systems
  .1 Conductors
  .2 Conduit and pull boxes
.5 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.14 Item 14- Civil, including buried tanks, piping and earthworks (Division 31, 32, 33)
.1 Supply and installation of secondary containment waste tank
.2 Installation of yard piping/watermains at the project site
  .1 Modifications to existing storm drainage systems and construction of new storm drainage systems,
  .2 Flushing of existing watermains installed during Phase 1 of the project as noted on the drawings,
  .3 Installation of underground diluted caustic soda pipe,
  .4 Tie-ins of watermains installed as part of Phase 1 of the project as noted on the drawings and in the staging plan
  .5 Pressure testing and disinfection of all new watermains and watermains installed in Phase 1
  .6 Transition couplings between mechanical and civil piping
.3 Excavations work including:
  .1 Building and tank excavations
  .2 Backfill, placement and compaction of import material
  .3 Restoration
.4 Grading and Paving
  .1 Rough grading
  .2 Finished grading
  .3 Paving
.5 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.15 Item 15 - HVAC systems (Division 43)
.1 Installation of heating and ventilation system:
  .1 Louvers, dampers, ducting and heaters.
.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

.16 Item 16 – Water and Wastewater Equipment (Division 46)

.1 Chemical Feed – Liquid Systems

.2 Payment: Payment will be made at the lump sum price based on the Engineer's estimate of the percentage of work items completed.

1.6 PROVISIONAL ITEMS

.1 Rock Removal

.1 Removal of bedrock using rock breaking methods such as hammering and ripping and excluding blasting

.2 Payment will be paid at the unit rates based on the in-situ measured quantity.

.2 Over Excavation and Backfill

.1 Over excavation of unsuitable material and backfill and compaction with crushed granular sub-base.

.2 Payment will be paid at the unit rates based on the in-situ measured quantity

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 25 00
SUBSTITUTION PROCEDURES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Requirements applicable to all substitution requests.

.2 Provisions specific to Contractor's substitution requests for:

.1 Materials and equipment to be incorporated into the Work.

.2 Methods, procedures, and sequences indicated in the Contract Documents.

.2 Scope:

.1 Contractor shall provide all labour, materials, equipment, tools, services, and incidentals and pay all costs associated with requests for approval of substitutes.

.2 Where the Contract Documents expressly indicate that substitutes are not allowed, unacceptable, or time-barred, do not submit substitution requests for such items or procedures.

.3 Requirements for the Contractor's proposal of "or-equals", where allowed by the Contract, are in Section 01 25 00 - Substitutions.

.3 Related Requirements:

.1 Include, but are not necessarily limited to:

.1 General Conditions.

1.2 REFERENCES

.1 Terminology:

.1 The following terminology, although not indicated with initial capital letters, has the following meaning in this Section:

.1 "**Or-equal**" and "**or equal**" means material or equipment items to be incorporated into the completed Work as a functioning whole, or method, procedure, or sequence that, in Engineer's sole opinion, are equivalent to that shown or indicated in the Contract Documents.

.2 "**Substitute**" means a proposed material or equipment to be incorporated into the completed Work as a functioning whole or a proposed construction method, procedure, or sequence that is not, in Engineer's sole opinion, equivalent to the associated, similar material or equipment item or method, procedure, or sequence shown or indicated in the Contract Documents, but accomplishes the same or similar purpose. Unless expressly indicated otherwise in the Contract Documents, Contractor's proposals for "value engineering" (and similar terms) are substitutes.

.3 "Substitution request" means Contractor's written request for Engineer's approval of a proposed substitute in accordance with this Section. Substitution requests are separate from Shop drawings and other Submittals required by the Contract Documents.

1.3 SUBSTITUTES - GENERAL

.1 This Article applies to all substitutes and substitution requests, whether for substitute materials or equipment or for substitute methods, procedures, or sequences.

.2 This Section expands on the provisions on substitutes in the General Conditions, as may be modified by the Supplementary Conditions.

.3 Time Limits for Submitting Substitution Requests:

.1 Where the Contract allows Contractor's substitution requests, such proposals will be considered by Engineer only during a period of 30 days after the date the Contract Times start to run unless otherwise indicated.

.2 Substitution requests will be accepted for consideration by Engineer after the time limit indicated in the paragraph above this when materials or equipment shown or indicated, and all associated "or-equals", are either:

.1 Unavailable; or

.2 Despite Contractor's due diligence, are unavailable in time for the Work to be completed within the Contract Times.

.3 The foregoing notwithstanding, substitutes will not be approved when received by Engineer after Contractor has commenced the associated Work at the Site, where approval of the substitute would require rework or removal the Work already installed.

.4 Design Professional:

.1 Engineer is responsible for design of the completed Project as a functioning whole and has responsible charge of the Project except for Work for which design responsibility is expressly delegated by the Contract Documents.

.2 Do not retain the services of any third-party design professional to prepare modifications of Engineer's design of the completed Project as a functioning whole without Engineer's express, written consent via an appropriate Contract modification setting forth appropriate performance and design criteria for delegating the design of the substitute.

.5 Contractor's Representations:

.1 In submitting each substitution request, Contractor represents that:

.1 Contractor has read and understands the Contract's provisions on substitutes, as indicated in this Section and elsewhere in the Contract Documents.

.2 Substitution request is complete and includes all documents and information required by the Contract Documents.

.3 Contractor certifications required by this Section are valid and made with Contractor's full knowledge, information, and belief.

.4 Contractor will provide the same or better guarantees and warranties for substitutes as for the specified materials, equipment, methods, procedures, and sequences (as applicable).

.5 Contractor waives all rights for increasing the Contract Price or extending the Contract Times, related to the substitute, that subsequently may become apparent to Contractor after issuance of the associated Contract modification instrument approving such substitute, except for those associated with differing subsurface or physical conditions or discovery of a previously unforeseen Hazardous Environmental Condition associated with the Work involving the approved substitute.

.6 Submittal of Substitution Requests - General:

.1 Substitution requests must be submitted by Contractor. Engineer will not accept or review substitution requests from prospective or bona-fide Subcontractors or Suppliers.

.2 Submit separate substitution requests for each proposed substitute.

.3 Submit substitution requests in accordance with requirements for Shop Drawings and other Submittals, as indicated in Section 01 33 00 - Submittal Procedures.

.4 Do not submit substitution requests as any of the following (such substitution requests will be returned by Engineer without review):

.1 Shop Drawing, Sample, or other Submittal.

.2 Request for approval of an "or-equal".

.3 Request for interpretation (RFI) or clarification.

.4 Change Proposal without all other, required substitution request elements indicated below.

.5 Other oral or written communication not in accordance with this Section.

.5 Each substitution request shall include:

.1 Transmittal letter (one per substitution request) expressly indicating the communication is a substitution request.

.2 Completed substitution request form, on the form attached to this Section.

.3 Change Proposal, submitted in accordance with the Contract Documents. Clearly indicate the proposed changes in Contract Price and Contract Times if a substitute is approved; if none, clearly indicate on the Change Proposal.

.4 Certifications and written representations required by the Contract Documents to accompany substitution requests.

.5 Other information: (1) required elsewhere in this Section and other elements of the Contract Documents, and (2) deemed appropriate by Contractor to support Contractor's substitution request.

.6 When Engineer requires additional information to evaluate a substitution request, furnish such information within five days of receipt of Engineer's request, unless additional time is granted by Engineer, in writing.

.7 Engineer and Owner have the right to rely upon the completeness and accuracy of information, documents, certifications, and representations in Contractor's substitution request. Contractor accepts full responsibility for completeness and accuracy of substitution requests (except for Engineer's professional liability).

.7 Engineer's Review of Substitution Requests:

.1 Engineer has no obligation to approve any substitute.

.2 Substitutes will not be approved unless all of the following are satisfied for the associated substitute:

.1 The Contract supports submittal of such substitution request; and

.2 Substitute is reasonably consistent with Engineer's design intent for the Project as a completed, functioning whole.

.3 Substitute will not have an adverse effect on the work of other contractors, or existing or proposed construction.

.4 Substitution request is complete in accordance with the Contract Documents and Engineer's requests.

.5 Owner agrees to the substitute.

.6 Associated changes in Contract Price and Contract Times, if any, are acceptable to Owner.

.3 Engineer is not obligated to approve any substitute where such approval is conditioned on an increase in the Contract Price, the Contract Times, or both.

.4 Timeliness of Engineer's Review:

.1 Allow not less than 7 days for Engineer's review of each substitute.

.2 Engineer will endeavor to perform timely review of substitution requests. However, Contractor is responsible for complying with the Contract Times, regardless of whether the substitute is approved.

.3 Where approval of a substitute would necessitate other changes to the Project's design, additional time, beyond that indicated above, will be necessary for Engineer's preparation of revisions to the design.

.5 When Design Changes are Required with Approval of Substitute:

.1 Engineer will advise Contractor promptly following Engineer's review (and Owner's comment, if any) on substitution request to indicate whether the substitute will be acceptable. Engineer's advisory to Contractor will indicate whether changes in Engineer's design are necessary and include a preliminary estimate of Engineer's fee and time required for modifying the design and preparing an associated Proposal Request to Contractor.

.2 Engineer's preliminary estimates of fee and time for design modifications will be prepared in good faith but are not binding on Owner or Engineer.

.3 Contractor shall reimburse Owner for costs incurred by Owner for design modifications necessitated by approval of substitute. Owner may deduct such amounts, as one or more set-offs, from payments due Contractor under the Contract.

.4 Upon Contractor's receipt of Engineer's estimate of fee and time for design modifications, contractor shall advise Engineer, in writing, within three days whether Contractor will continue pursuing approval of the substitute.

.5 Request to Contractor.

.6 Engineer may reject a substitute that would require substantial changes in the Project's design.

.8 Approval of Substitutes:

.1 Substitutes are approved only via issuance of an appropriate Field Order.

.2 Approval of a substitute does not relieve Contractor from obligation to comply with the Contract Documents, including submitting Shop Drawings, Samples, and other Submittals in accordance with the Contract Documents.

1.4 SUBSTITUTE MATERIALS AND EQUIPMENT

.1 In addition to other requirements of this Section and elsewhere in the Contract Documents, substitution requests for substitute materials or equipment shall include:

.1 Manufacturer and Location:

.1 Name and address of manufacturer of the proposed substitute. Indicate the country where manufacturer is incorporated and owned.

.2 Companies and brands owned by or affiliated with manufacturer.

.3 Name of manufacturers of principal component items, such as motors, bearings, and similar items.

.4 Name, address, and driving distance from the Site of:

.1 Manufacturer's sales representative.

.2 Nearest service center offering full array of service capabilities.

.3 Warehouse or other location where spare parts for the proposed substitute are available.

.5 Number of years that the manufacturer has actively participated in the North American market.

.2 Proposed Materials and Equipment:

.1 Model designation and quantity of each proposed for the Work.

.2 Manufacturer's literature for proposed substitute, with a description of the materials and equipment.

.3 Performance information and representative test data.

.4 Indication of reference standards with which materials and equipment comply.

.5 Preliminary process and instrumentation diagrams (P&ID), where applicable.

.6 Identification of hazardous materials, including Constituents of Concern, used in the materials and equipment, and associated permitting or licensing required.

.7 Manufacturer's standard warranty and applicable, proposed special or extended warranties, including indication of specific entities that will be beneficiary of such warranties.

.8 Complete list of proposed deviations from requirements of the Contract Documents.

.9 Itemized comparison of specified materials and equipment and proposed substitute, indicating:

.1 Size (physical dimensions) when: item is in use, when not in use, and space required for routine and major maintenance.

.2 Weight and loading at supports when item is full and empty.

.3 Materials of construction.

.3 Operation requirements, including:

.1 Anticipated consumption of each item of: Electricity, other energy sources, water, chemicals (indicate each), and other needs for operation at the Site.

.2 Typical labour required for operation and associated skill level.

.3 Description of remote monitoring and control capabilities, as applicable.

.4 Maintenance requirements, including:

.1 Anticipated life in the service and environment required.

.2 Frequency and general scope of routine and major maintenance typically necessary.

.3 Typical labour requirements and general qualifications of personnel performing routine maintenance.

.4 Major, associated equipment necessary for routing and major maintenance, including hoisting equipment type and capacity (when applicable).

.5 Availability, scope, cost, and general conditions of service and maintenance contracts, if any.

.5 Other information required by the Contract Documents.

.6 Other information reasonably requested by Engineer.

1.5 SUBSTITUTE CONSTRUCTION METHODS, PROCEDURES, OR SEQUENCES

.1 Provisions of the General Conditions, as may be modified by the Supplementary Conditions, regarding substitutes of materials and equipment are hereby extended to apply to substitute methods, procedures, and sequences as shown or indicated in the Contract Documents.

.2 In addition to other requirements of this Section and elsewhere in the Contract Documents, substitution requests for substitute methods, procedures, or sequences shall include:

.1 Clear identification of the method, procedure, or sequence shown or indicated in the Contract Documents for which substitute is requested.

.2 Detailed description of proposed substitute method, procedure, sequence, or combination thereof.

.3 Reasons why substitute is proposed and benefits to the Project should the substitute be approved.

.4 Detailed list of how the proposed substitute deviates from associated method, procedure, or sequence shown or indicated in the Contract Documents.

.5 Impact of the substitute, if approved, on Owner's or facility manager's operations, when the Work is at an existing facility.

.6 Effect on other contractors working at the Site, if substitute is approved.

.7 Description of temporary equipment and temporary facilities needed, should the substitute be approved, including quantity of items, capacities, performance characteristics, permitting and approvals required by authorities having jurisdiction, and proposed location at the Site.

.8 Written evaluation of how substitute method, procedure, or sequence complies with Laws and Regulations.

.9 Drawings illustrating method, procedure, or sequence.

.10 Materials to be used that contain Constituents of Concern or that have potential to cause or exacerbate a Hazardous Environmental Condition.

.11 Other information and data required by the Contract Documents.

.12 Other information reasonably required by Engineer.

2. PRODUCTS - (NOT USED)

3. EXECUTION

3.1 ATTACHMENTS

.1 The following, bound after this Section's "End of Section" designation, are part of this Specifications Section:

.1 Exhibit A - Substitution Request Form (one page).

END OF SECTION

EXHIBIT A Substitution Request Form
(One Item per each Form)

Project:	Date:	
Substitution Requestor:		
Contractor:		
Specification Section No:	Paragraph No. (i.e. 2.1.A.1.c):	Specified Item:
Proposed Substitution:		

Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal.

State differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality.

_____
_____
_____
_____

Document how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract

_____
_____
_____

Describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings?

_____
_____
_____

Describe what effect the proposed substitution has on the Construction Schedule and Contract Time.

_____
_____
_____

Describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs.

_____
_____
_____

Manufacturer's guarantees of the proposed and specified items are:

☐ Same ☐ Different (explain on attachment)

The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.

For use by Engineer: ☐ Accepted – eligible for approval via Change Order ☐ Accepted as Noted – approval via Change Order ☐ Not Accepted _____ *Date* *(Telephone)*:	_____ *(Contractor's Signature)* _____ *(Contractor's Firm)* _____ *(Firms Address)* _____ *(Telephone)*
_____ Signature of P.Eng in Responsible Charge	

Comments:

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SECTION 01 31 13
PROJECT COORDINATION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for:

.1 Coordination meetings.

.2 Coordination drawings and layout drawings.

.2 Scope:

.1 Contractor shall coordinate the Work, whether performed by Contractor's employees or by Subcontractors, Suppliers, or others for whom Contractor is responsible, to provide Work in accordance with the Contract Documents.

.2 Coordinate the Work with testing entities and inspectors (whether hired by Contractor, Owner, or others) employed on the Project, forces of Owner and facility manager (if other than Owner), and other contractors retained by Owner or facility manager, and other entities with which the Work needs to be coordinated.

.3 Requirements for preconstruction meetings are in the General Conditions (as may be modified by the Supplementary Conditions) and Section 01 31 19 - Project Meetings.

.4 Requirements for construction progress meetings are in Section 01 31 19 - Project Meetings.

.3 Related Requirements:

.1 Include, but are not necessarily limited to, the following:

.1 Section 01 11 00 - Summary of Work.

.2 Section 01 14 16 - Coordination with Owner's Operations.

.3 Section 01 31 19 - Project Meetings.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordination – General:

.1 In accordance with the General Conditions as may be modified by the Supplementary Conditions, and Section 01 11 00 - Summary of Work, Contractor shall coordinate the Work with, and cooperate with, other contractors, utility owners and their contractors, owners of transportation facilities and their contractors, Owner's and facility manager's workers at the Site, and other entities working at or adjacent to the Site.

.2 Comply with Section 01 14 16 - Coordination with Owner's Operations.

.2 Coordination, Inspection, and Observation to Ensure Quality:

.1 Contractor shall continuously inspect the Work throughout the Project to ensure that the Work complies with the Contract Documents.

.2 Inspect (including testing, where required or necessary) substrates and surfaces on which the Work will be constructed, applied, adhered, or attached, to ensure substrate and surface conditions are appropriate for providing Work in accordance with the Contract Documents.

.2 Coordination Meetings:

.1 Contractor's Coordination Meetings:

.1 Schedule, attend, chair, and actively participate in coordination meetings deemed appropriate by Contractor for purposes of coordinating the Work of Contractor's employees, Subcontractors, Suppliers, and others for whom Contractor is responsible.

.2 Frequency, location, date, time, and duration of Contractor's coordination meetings are at Contractor's discretion. Record and distribute to attendees and other members of Contractor's team a record of topics discussed, decisions made, and other relevant matters at Contractor's coordination meetings.

.3 Engineer, Owner, and Owner's Site Representative (if any) will not attend Contractor's coordination meetings.

.4 Toolbox meetings as required by WorksafeBC.

.3 Coordination Drawings and Layout Drawings:

.1 Maintain sufficient, competent personnel and supplies at Contractor's office and at the Site (as deemed appropriate by Contractor) for preparing layout drawings and coordination drawings.

.2 With the Contract Documents and Shop Drawings, use coordination drawings and layout drawings for coordinating the Work of various trades.

.3 Where such coordination drawings or layout drawings are to be prepared by Subcontractors such as electrical, process-mechanical, or other Subcontractors, ensure that each such Subcontractor maintains required personnel, implements, equipment, and systems at Subcontractor's office and at the Site (as deemed appropriate by Contractor).

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 31 19
PROJECT MEETINGS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Preconstruction, progress and other project meetings.

1.2 PRECONSTRUCTION MEETING

.1 Meet with the Owner and Engineer for a pre-construction conference at a time mutually agreed upon after the contract is awarded but before any work is performed

.2 The Engineer will schedule a meeting of the Owner, Contractor, and their respective representatives.

.1 The purpose of the meeting will be to clarify construction contract administration procedures, to establish lines of authority and communication and identify duties and responsibilities of the parties.

.3 The Engineer will compile meeting minutes from the transcribed record of the meeting and electronically distribute copies to all participants.

.4 Pre-Construction Conference Submittals:

.1 The names and telephone numbers of Contractor's Superintendent and Office Manager.

.2 List of personnel authorized to sign change orders and receive progress payments.

.3 The name, address and telephone numbers of two or more persons employed by the Contractor who can be reached at any time of the day or night to handle emergency matters.

.4 A list of all subcontractors that will work on the project, a description of work they will perform, and a contact list for each subcontractor with phone numbers and addresses.

.5 A draft proposed Construction Schedule.

1.3 PROGRESS MEETINGS

.1 Bi-Weekly progress meetings will be held at a location determined by the Engineer, unless otherwise arranged.

.2 Attendees will include the Owner, Engineer, Contractor, subcontractors, and suppliers' representatives as may be needed

.3 Bring a two-week look ahead schedule to each meeting, including the following items:

.1 Work completed last week.

.2 Work anticipated for the next two weeks ("Look Ahead").

.3 Subcontractors on site the prior week.

.4 Subcontractors scheduled on-site for the next two weeks.

.5 Contract document deficiencies or questions noted during prior week.

.6 Anything that could impede the progress of the work or affect the critical path on the project schedule.

.7 Corrective measures and procedures to regain planned schedule, cost or quality assurance, if necessary.

.8 Report any accidents and site safety issues that need to be addressed.

.4 Minutes of Meeting:

.1 The Engineer will compile minutes of each project meeting and will furnish electronic copies to the Contractor.

1.4 OTHER MEETINGS

.1 Other meetings will be required to facilitate progress of the Work. These include, but are not limited to the following:

.1 Pre-Installation Meetings:

.1 Coordinate and schedule with Engineer for each material, product or system specified.

.1 Meetings to be held prior to initiating installation, but not more than two weeks before scheduled initiation of installation.

.2 Meetings may be combined if installation schedule of multiple components occurs within the same two week interval.

.3 Review manufacturers' recommendations and Contract Documents Specification Sections.

.2 Facility Startup Planning and Coordination Meeting. See Section 01 75 00.

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Specific requirements for the preparation, submittal, updating, and status reporting of the construction Progress Schedule.

.2 Review of the Critical Path Method (CPM) Schedule:

.1 In so far as the Contractor is solely responsible for its means and methods and the CPM schedule represents in part its means and methods, the review of the CPM schedules (preliminary, baseline, updates, revisions, etc.) is for compliance with the requirements as defined in the contract documents.

.2 The review of the CPM schedule is not intended to be complete or exhaustive or check every activity and its relation to the work.

.3 The Engineer will provide comments on the CPM schedule compliance with those contract requirements and anomalies that might appear to the Engineer.

.4 If the Contractor fails to include contract requirements (e.g. specified cure times, commissioning periods) in the CPM schedule, or the Engineer fails to notify the Contractor of anomalies, the Contractor is not relieved of the contract requirements.

.5 Acceptance of the CPM schedule does not imply that the Owner has approved or accepted the Contractor's means and methods or sequence for performing the work to construct the project.

.6 If the Contractor has questions or concerns about comments, the Contractor and Engineer shall meet to resolve those issues prior to the issuance of future updates or revisions.

1.2 DEFINITIONS

.1 The following definitions shall apply to this Specification Section:

.1 Execution Of The Contract: The date the contract is signed by the last party, either the Owner or the Contractor.

.2 Working Days: Monday through Friday except for holidays as directed by the Owner.

.3 Preliminary Schedule: A schedule showing detailed activity for the first 30 days of the Project and a general work plan for construction activity from the 31st day until the Contractual Completion Date.

.4 Baseline Schedule: The initial detailed Progress Schedule prepared by the Contractor defining its plan for constructing the Project in accordance with the Contract Documents.

.5 Schedule Update: The initially accepted Baseline Schedule, or subsequently approved Revised Baseline Schedules, are updated each month to reflect the actual start and finish dates of each scheduled activity and the remaining duration of activities that began during the period.

.6 Current Schedule: The current schedule is either the Baseline Schedule or the Revised Baseline Schedule, including and incorporating Schedule Updates.

.7 Revised Baseline Schedule: The initially accepted Baseline Schedule revised to reflect approved contract change orders and modifications.

.8 Recovery Schedule:

.1 A schedule indicating the Contractor's plan for recovering lost time.

.2 A recovery schedule will be requested when the Contractor is forecasting at least 10 working days or more delays in meeting a contract milestone or the contract completion date.

.9 Short Interval Schedule:

.1 Schedule prepared by the Contractor reflecting the work planned for the coming weeks.

.2 This is also known as a Look-Ahead Schedule.

1.3 SUBMITTALS

.1 Preliminary Schedule:

.1 Submittal and review:

.1 Submit within 14 calendar days after the Execution of the Contract or the effective date of the contract, whichever is earlier.

.2 The Engineer will review and provide comments to the Contractor within 5 working days after receipt of the schedule.

.3 The Contractor will review and modify the preliminary schedule and return the schedule within 5 working days. If there are concerns about the comments provided, the Engineer and Contractor will meet to review and resolve those concerns.

.2 Short Interval Schedule:

.1 Provide a two-week schedule each week during the Contract Time. This schedule can be reviewed at each progress meeting.

.1 Provide an accurate representation of the work performed the previous week and work planned for the current week and subsequent two weeks.

.2 Identify inspection hold points, including special inspections needed before the Contractor can proceed with the work.

.3 Identify the day materials provided by the Owner or others needed on site.

1.4 GENERAL REQUIREMENTS

.1 Prepare and submit construction progress schedules as specified herein.

.1 Develop and maintain Baseline, Updates and Recovery schedules using Microsoft Project or equal as approved by the Engineer.

.2 Include the following information:

.1 Construction start dates (Award date, Notice(s) to Proceed date).

.2 Procurement activities.

.3 Preparation of key submittals for materials and equipment.

.4 Engineers' review and approval of key submittals.

.5 Material and equipment fabrication lead times.

.6 Material and equipment deliveries for Contractor, Owner and third parties.

.7 Shut Downs.

.8 Plant tie-ins.

.9 Inspections and hold points.

.10 Start-up of equipment.

.11 Testing of equipment and systems.

.12 Commissioning.

.13 Contract milestones:

Substantial Completion Date.

.2 Plan working durations to incorporate the effects of normal weather impacts.

.3 Float:

.1 The project owns the float, therefore neither the Owner nor the Contractor has exclusive use of the float; the float can used by either party.

.2 Once float is used, liability for delay of the project completion date rests with the party actually causing delay to the project completion date.

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 33 00
SUBMITTAL PROCEDURES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Definition of various types of Submittals.

.2 Coordination requirements for Submittals.

.3 General provisions concerning Submittals.

.4 Schedule of Submittals.

.5 Contractor's preparation of Submittals, including:

.1 Numbering.

.2 Marking.

.3 Organization and content.

.4 Proposed "or-equals", substitutes, and deviations from Contract requirements.

.5 Electronic Documents Submittals.

.6 Contractor's review and approval of each Submittal.

.7 Resubmittals.

.6 Contractor's transmittal of Submittals, including transmittal letters, transmittal and delivery method, and delivery of Samples, Closeout Submittals, and Maintenance Materials Submittals.

.7 Engineer's review, including:

.1 Timing.

.2 Meaning of Engineer's Submittal action code (disposition) assigned.

.3 Delivery of Engineer's responses on Submittals.

.2 Scope:

.1 Contractor shall provide all labour, materials, equipment, tools, services, incidentals, and other efforts necessary to furnish Shop Drawings, product data Submittals, Samples, and other Submittals in accordance with the Contract Documents.

.2 This Section's Article, "General Provisions Concerning Submittals" includes a summary of the Contract Documents' locations of Submittals requirements.

.3 Shop Drawings, product data Submittals, Samples, and other Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Engineer's approval or acceptance, as applicable, of a Submittal, does not alter or modify the Contract Documents.

.4 Engineer and Owner have the right to rely on Contractor's representations and certifications made regarding each Submittal.

.3 Related Requirements: Include but are not limited to:

.1 General Conditions.

.2 Section 01 25 00 - Substitution Procedures.

.3 Section 01 32 16 - Construction Progress Schedule.

1.2 REFERENCES

.1 References – Introduction:

.1 This Article presents definitions and terminology used in this Section and throughout the Contract Documents.

.2 Applicability of the Term "Submittals": Where reference is made to Shop Drawings, product data Submittals, Samples, or other Submittals in this Section and elsewhere in the Contract Documents, the term "Submittals", as defined in the Contract Documents, is intended. The foregoing applies regardless of whether such term is indicated with an initial capital letter, unless context of the subject provision clearly indicates otherwise.

.3 Types of Submittals:

.1 Submittal types are classified as follows: (1) Action Submittals, (2) Informational Submittals, (3) Closeout Submittals, and (4) Maintenance Materials Submittals.

.2 Type of each required Submittal is indicated in the associated Specifications section. When Submittal type is not clearly indicated in the associated Specifications section, Submittal will be classified as indicated in this Article. Submit a request for interpretation when Contractor is uncertain of required Submittal type.

.2 Action Submittals:

.1 Action Submittals require an explicit, written approval or other appropriate action by Engineer (or other entity to whom the Submittal is required to be furnished, in accordance with the Contract Documents) before Contractor may release the associated item(s) for raw materials procurement, fabrication, production, and shipping.

.2 Unless otherwise indicated in the Contract Documents, Action Submittals include the following:

.1 Shop Drawings.

.2 Product data.

.3 Samples.

.4 Testing plans for quality control activities required by the Contract Documents.

.3 General Conditions' requirements for Shop Drawings and Samples hereby apply to all Action Submittals.

.3 Informational Submittals:

.1 Informational Submittals are so indicated in the Contract Documents. Unless otherwise indicated, Informational Submittals include certifications, evaluation reports, results of source quality control activities, results of field quality control activities, Supplier instructions, reports of Suppliers' visits to the Site, sustainable design Submittals (that are not Closeout Submittals), qualifications statements, and others.

.2 Informational Submittals, when submitted in accordance with the Contract and indicating full compliance with the Contract Documents, do not require an explicit response from Engineer (or other entity to whom the Submittal is to be delivered); Engineer's (or other entity's) acceptance thereof will be indicated in the Engineer's Submittals log. Copy of Engineer's Submittals log is available to Contractor upon Contractor's written request.

.3 When Informational Submittal does not indicate full compliance with the Contract Documents, Engineer (or other entity to which Submittal is to be delivered) will indicate the non-compliance in a written response to Contractor.

.4 Closeout Submittals:

.1 Closeout Submittals are so indicated in the Contract Documents and are, in general, required before the associated Work is completed unless earlier submittal is required by the Contract Documents.

.2 Unless indicated otherwise in the Contract Documents, Closeout Submittals include operation and maintenance data, keys, and others.

.3 Closeout Submittals are processed in the same manner as described above for Informational Submittals.

.5 Maintenance Materials Submittals:

.1 Maintenance materials include spare parts, extra materials, tools, and similar items required to be furnished in accordance with the Contract Documents.

.2 Furnish required physical maintenance materials, delivered to Owner or facility manager (if other than Owner), as applicable, at the location(s) indicated in the Contract Documents, for the corresponding required Maintenance Materials Submittals.

.3 Maintenance Materials Submittals are documentation of delivery to Owner's or facility manager, and their acceptance of, required physical maintenance materials.

.4 Maintenance Materials Submittals are processed in the same manner as described above for Informational Submittals.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Furnish Submittals well in advance of need for the associated material or equipment, or procedure (as applicable), in the Work and with ample time necessary for the delivery of materials and equipment and to implement procedures following Engineer's approval or acceptance of the associated Submittal.

1.4 SCHEDULE OF SUBMITTALS

.1 Informational Submittals: Submit the following:

.1 Schedule of Submittals:

.1 Timing:

.1 Furnish Schedule of Submittals within time frames indicated in the General Conditions, as may be modified by the Supplementary Conditions.

.2 Submit an updated Schedule of Submittals with each submittal of the updated Progress Schedule.

.2 Content: Identify on the Schedule of Submittals all Submittals required in the Contract Documents. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Clearly indicate Submittals that are on the Project's critical path. Indicate the following for each Submittal:

.1 Date by which Submittal will be received by Engineer.

.2 Whether the Submittal will be for a substitution or "or-equal".

.3 Date by which Engineer's response is required. Allow not less than 14 days for Engineer's review, starting on Engineer's actual receipt of each Submittal. Allow increased time for large or complex Submittals.

.4 For Submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of others (if any).

.3 Prepare Schedule of Submittals using same software, and in same format, specified for Progress Schedules in Section 01 32 16 - Construction Progress Schedule.

.4 Coordinate Schedule of Submittals with the Progress Schedule.

1.5 PREPARATION OF SUBMITTALS

.1 Prior to Submittal Preparation:

.1 The General Conditions, as may be modified by the Supplementary Conditions, address Contractor's responsibility for submitting for Owner's acceptance identification of Subcontractors and Suppliers. Obtain Owner's acceptance before entering into subcontracts and purchase orders for the Work.

.2 Comply with the Contract Documents relative to terms and conditions of subcontracts and purchase orders for the Work.

.3 Contractor's responsibilities for the following are set forth in the General Conditions, as may be modified by the Supplementary Conditions, and as may be augmented elsewhere in the Contract Documents:

.1 Obtaining field measurements and dimensions.

.2 Determining and verifying required quantities.

.3 Verifying compatibility of materials.

.4 Apportioning the Work among Subcontractors, Suppliers, and Contractor.

.5 Reconciling required materials, equipment, and other Contract requirements with Contractor's means, methods, techniques, sequences, and procedures of construction and with Contractor's safety and protection programs and precautions incident thereto.

.6 Reviewing applicable provisions of the Contract Documents and obtaining from Engineer necessary interpretations or clarifications.

.2 Submittal Identification:

.1 Submittal Number: Shall be a unique number assigned to each individual Submittal. Assign Submittal numbers as follows:

.1 First part of Submittal number shall be the applicable Specifications section number, followed by a hyphen.

.2 Second part of Submittal number shall be a three-digit number (sequentially numbered from 001 through 999) assigned to each separate Submittal furnished under the associated Specifications section.

.2 Review Cycle Number: Shall be a letter designation indicating the initial submittal or resubmittal associated with each Submittal number:

.1 "A" = Initial (first) submittal.

.2 "B" = Second submittal (i.e., first resubmittal).

.3 "C" = Third submittal (i.e., second resubmittal).

.3 Submittal Organization and Content – General:

.1 Page or Sheet Size; Furnish Submittals with one or more of the following page or sheet sizes: (a) 8.5 IN by 11 IN; (b) 11 IN by 17 IN; (c) 22 IN by 34 IN; unless another sheet size is acceptable to Engineer.

.2 Language: All parts of each Submittal shall be in the English language.

.3 Units of Measurement: Clearly indicate units of measurement on Shop Drawings, product data Submittals, record documentation, and operation and maintenance data Submittals.

.4 Organize each Submittal logically to facilitate ease of understanding and review.

.5 To the extent practicable, arrange Submittal information in same order as requirements are written in the associated Specifications section.

.6 To the extent practicable, package together Submittals for the same Specifications section. Do not furnish required information piecemeal.

.7 For large or complex Submittals, include a title page and table of contents.

.8 Include appropriately labeled fly sheets to separate distinct parts of each Submittal.

.9 Ensure legibility of all pages in each Submittal.

.10 Minimize extraneous and unnecessary information in Submittals for materials and equipment. Do not submit information not relevant to the Submittal and associated requirements of the Contract Documents.

.11 Contractor's, Subcontractor's, and Supplier's written comments on Shop Drawings and product data diagrams shall be colored green

.12 Do not submit under Specifications sections with title that include "Basic Requirements", unless the subject material or equipment is specified, in total, in a Specifications section with the words, "Basic Requirements" in its title.

.4 Electronic Documents Submittals:

.1 Format: Electronic Documents Submittals shall be "portable document format" (.PDF) files unless expressly required otherwise by applicable provisions of the Contract Documents.

.2 Electronic Documents Submittals must be electronically searchable when delivered to Engineer and other recipients.

.3 Organization and Content:

.1 Each Electronic Documents Submittal shall be one file; do not divide individual Submittals into multiple Electronic Documents files each unless file size will exceed 10 MB.

.2 When Submittal is large or contains multiple parts, furnish PDF file with suitably titled electronic bookmark for each section of the Submittal.

.3 Content shall be identical to paper or other original Submittal. First page of each Electronic Documents Submittal shall be Contractor's transmittal letter.

.4 Quality and Legibility: Electronic Documents Submittal files shall be made from the original and clear and legible. Markings applied by Contractor, Subcontractor, or Supplier shall be clear, distinct, and readily apparent. Electronic Documents files shall be the full size of original documents. Properly orient all pages for convenient reading on a computer display; do not furnish pages sideways or upside-down.

.5 Proposed "Or-Equals", Substitutes, and Deviations from Contract Requirements:

.1 "Or-Equals":

.1 The meaning of "or-equal" is addressed in Section 01 25 00 - Substitution Procedures.

.2 Expressly and prominently indicate, "Proposed Or-Equal" on the associated Action Submittals when Submittal is for an "or-equal".

.3 Submittals requesting approval of an "or-equal" but not accompanied by the required, supplemental information will be deemed incomplete by Engineer and returned to Contractor without approval.

.2 Substitutes:

.1 The meaning of "substitute" is indicated in Section 01 25 00 - Substitution Procedures.

.2 Requests for approval of substitutes shall comply with Section 01 25 00 - Substitution procedures, and other relevant provisions of the Contract Documents.

.3 Contractor's request for approval of substitute is separate from the associated Action Submittal(s). Action Submittals that request approval of a substitute when a separate, formal substitution request furnished in accordance with the Contract Documents was not previously furnished to Engineer, followed by formal approval via an appropriate contract modification typically either a Field Order or Change Order, will be deemed by Engineer as non-compliant with the Contract Documents and will be returned to Contractor without approval.

.4 Contractor is solely responsible for delays incurred due to substitutes proposed via Submittals that have not been previously duly approved via an appropriate Contract modification.

.5 Action Submittals for items or procedures approved via an appropriate Contract modification shall include a copy of the Contract modification in which the substitute was approved.

.6 Resubmittals:

.1 Contractor shall furnish Submittals with such completeness, accuracy, and compliance with the Contract Documents to obtain Engineer's approval or acceptance, as applicable, without the total quantity of Submittals furnished, including all initial Submittals and all resubmittals, exceeding 150 PCT of the number of Submittals indicated on the Schedule of Submittals initially accepted by Engineer, plus a corresponding percentage of the quantity of Submittals required by Change Orders, Work Change Directives, and Field Orders.

.2 Do not increase the scope of prior review cycle of the same Submittal.

.3 Indicate on Contractor's transmittal letter how Submittal was revised from previous review cycle of the Submittal and where the revisions or corrections are located within the resubmittal.

.4 Expressly address and provide responses for all components previously transmitted by Engineer on prior review cycles of the subject Submittal. Where resubmittal lacks complete response to Engineer's prior comments, Engineer may deem such resubmittal as incomplete and return it to Contractor without further review.

.5 Where part of the Submittal's prior review cycle was expressly approved or accepted, as applicable, by Engineer, do not include such items in subsequent resubmittals.

.6 Indicate, "Not Yet Resolved—To Be Resubmitted at a Later Date" for any items not approved in prior review cycle of the Submittal for items not included in the subject resubmittal. Engineer reserves the right to deem incomplete Submittals "Not Approvable" or "Revise and Resubmit". Furnishing incomplete or partial resubmittals is discouraged.

.7 Resubmittal of Previously Approved or Accepted Items:

.1 Do not resubmit on a given item previously approved or accepted, as applicable, by Engineer, without Engineer's advance consent. Consent will be given for bona-fide unavailability of a previously approved or accepted item where Contractor has acted in good faith in a timely manner with due diligence to comply with the Contract Times.

.2 Destroy or conspicuously mark "SUPERSEDED" on all documents having previously received Engineer's approval or acceptance, as applicable, that are superseded by a resubmittal.

1.6 TRANSMITTAL OF SUBMITTALS BY CONTRACTOR

.1 Contractor's Transmittal Letters for Submittals:

.1 Furnish separate transmittal letter with each Submittal. Each Submittal shall be for one Specifications section.

.2 At beginning of each transmittal letter, include a reference heading indicating: Contractor's name, Owner's name, Project designation, Contract designation, transmittal number, and Submittal number (with review cycle).

.3 "Or-Equals": When the Submittal is proposing an "or-equal", expressly so indicate on Contractor's transmittal letter.

.4 Proposed Deviations from Contract Requirements: When the Submittal proposes deviations from requirements of the Contract Documents, transmittal letter shall specifically describe each proposed deviation:

.2 Submittal Delivery Method:

.1 This provision presents general requirements for delivery or all Submittals unless otherwise required elsewhere in the Contract Documents.

.2 Furnish Submittals to Engineer and each other entity indicated in the Contract Documents as receiving a Submittal directly from Contractor.

.3 Address Submittals to Engineer as follows: HDR, #500 - 1500 W Georgia Street, Vancouver, BC, V6G 2Z6, to the attention of Walt Bayless,walter.bayless@hdrinc.com.

.3 Closeout Submittals –Transmittal and Delivery:

.1 Furnish the following Closeout Submittals in accordance with general requirements for transmitting and delivering Submittals, indicated above in this Article: warranty documentation.

.2 Record Documents: Submit in accordance with Section 01 78 39 - Project Record Documents.

1.7 ENGINEER'S REVIEW OF SUBMITTALS

.1 This Article applies to the review of all Submittals by the Engineer or other entity to whom the Contract Documents require such Submittal be furnished.

.2 Timing:

.1 Timing of Engineer's review will be in accordance with the Schedule of Submittals accepted by Engineer.

.2 When Submittal is delivered to Engineer on a date other than that indicated in the Schedule of Submittals accepted by Engineer, duration of Engineer's review may differ from that indicated in the Schedule of Submittals, based on Engineer's availability and resources. Engineer will make good-faith effort to furnish responses to Submittals in a timely manner.

.3 Contractor is responsible for communicating to Engineer when a Submittal is on the Project's critical path.

.3 Engineer's Review:

.1 Markings:

.1 Comments or responses marked directly on Submittal by Engineer (or other entity reviewing Submittal) will be coloured red.

.2 Engineer may also present narrative comments on a comment sheet inserted by Engineer into the Submittal or included on Engineer's transmittal letter for the Submittal. Such comments will be in black text. When a separate comment sheet is included by the Engineer, such sheet will be clearly identified as Engineer's comments.

.2 Engineer's review and disposition assigned to Submittal are subject to the following:

.1 Submittal disposition is subject to: Engineer's comments on the Submittal; disclaimer language on Engineer's Submittal transmittal letter; Engineer's Submittal review stamp (when used) or equivalent (when used); and this provision.

.2 Engineer's review is only for general compatibility with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents and for general compliance with the information given in the Contract Documents.

.3 Contractor shall be solely responsible for complying with the Contract Documents, as well as with Supplier instructions consistent with the Contract Documents, Owner's directions, and Laws and Regulations. Contractor is solely responsible for obtaining, correlating, confirming, and correcting dimensions at the Site; quantities; information and choices pertaining to fabrication processes; means, methods, sequences, procedures, and techniques of construction; safety precautions and programs incident thereto; and for coordinating the work of all trades.

.4 Engineer is not responsible for resubmittals not yet furnished by Contractor or tracking Contractor's progress on resubmittals.

.3 Documents not required by the Contract Documents but nonetheless furnished by Contractor as submittals will not be reviewed by Engineer.

.4 Meaning of Submittal disposition Assigned by Engineer:

.1 Action Submittals:

.1 "Approved": Upon return of Submittal marked "Approved", order, ship, or fabricate materials and equipment included in the Submittal or otherwise proceed with the Work in accordance with the Submittal and the Contract Documents.

.2 "Approved as Noted": Upon return of Submittal marked "Approved as Noted", order, ship, or fabricate materials and equipment included in the Submittal or otherwise proceed with the Work in accordance with the Submittal and the Contract Documents, and in accordance with Engineer's comments and notes indicated in Engineer's Submittal response

.3 "Revise and Resubmit": Upon return of Submittal marked "Revise and Resubmit", make the revisions necessary and indicated and resubmit to Engineer for approval.

.4 "Rejected": This disposition indicates material or equipment that cannot be approved. "Rejected" disposition may also be applied to Submittals that are incomplete. Upon return of Submittal marked "Rejected", repeat the initial submittal procedure utilizing approvable material or equipment, with a complete Submittal clearly indicating all information required.

.2 Informational, Closeout, and Maintenance Materials Submittals:

.1 "Accepted": Information included in Submittal complies with the applicable requirements of the Contract Documents and is acceptable. No further action by Contractor is required relative to such Submittal, and the Work covered by the Submittal may proceed. Materials and equipment with Submittals with this disposition may be shipped or operated, as applicable. Submittals assigned "Accepted" by Engineer (or other reviewing entity) does not indicate Engineer's acceptance of the associated Work, which is indicated only as set forth in the General Conditions.

.2 "Not Acceptable": Submittal, or part thereof, does not indicate full compliance with applicable requirements of the Contract Documents and is not acceptable. Provide labour, materials, equipment, services, and incidentals necessary to properly and accurately revise Submittal and resubmit to indicate acceptability and compliance with the Contract Documents

.3 Other:

.1 "Submittal Not Reviewed": Documents so marked by Engineer are not required by the Contract Documents. Submittals may also be marked with this disposition when information in the document was previously reviewed and approved or accepted by Engineer, as applicable.

.5 Distribution of Engineer's Responses:

.1 Unless otherwise indicated in the Contract Documents, Engineer will distribute written responses (as Electronic Documents) to Submittals to the following:

.1 Contractor.

.2 Owner.

.3 Engineer's file.

.2 Engineer's acceptance of Informational Submittals, Closeout Submittals, and Maintenance Materials Submittals will be recorded in Engineer's Submittal log. Copy of Engineer's Submittals log is available from Engineer upon written request of Owner or Contractor. If no such request is received by Engineer, Engineer will distribute copy of Engineer's Submittals log once per month (when Submittals have been received or acted on by Engineer). Engineer may distribute copy of Engineer's Submittals log as an Electronic Document or as handout at construction progress meetings.

.3 Paper copies of Engineer's Submittal responses will not be distributed unless otherwise required by the Contract Documents or otherwise agreed to by Engineer.

.4 Contractor is responsible for forwarding Engineer's Submittals responses to Subcontractors and Suppliers as appropriate, and for coordinating the Work of all trades.

2. PRODUCTS - (NOT USED)

3. EXECUTION

3.1 ATTACHMENTS

.1 The documents listed below, following this Section's "End of Section" designation, are part of this Specifications Section:

.1 "Exhibit 01 33 00-A - Engineer's Submittal Transmittal" (one page).

END OF SECTION

EXHIBIT 01 33 00-A

Engineer's Submittal Transmittal No. _____

(Spec Section) (Series)

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Corporation, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn:	Attn:	1st. Sub	
Date Transmitted:	Previous Transmittal Date:		

Item No.	Submittal No.	Description (indicate number of copies where paper copies of physical Samples are returned)	Manufacturer	Supplier Dwg or Data No.	Engineer's Disposition (Action Code) *
1					
2					
3					
4					
5					

Remarks:

* **Legend for Action Code** indicated above, assigned by Engineer:

Action Submittal:
- A – Approved
- B – Approved as Noted
- C – Revise and Submit
- D – Rejected
- E – Submittal Not Reviewed

Informational, Closeout, or Maintenance Materials Submittal:
- F – Accepted (this code normally recorded in Engineer's Submittals log).
- G – Not Acceptable

Engineer's Disclaimer (for Submittals that do not involve delegated design):

a. Submittal action code is subject to: Engineer's comments on the Submittal, comment sheets (if any), and this transmittal letter; disclaimer language on Engineer's Submittal review stamp or equivalent; and Specifications Section 01 33 00 – Submittal Procedures.

b. Engineer's review is only for general compatibility with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents, and for general compliance with the information given in the Contract Documents.

c. Contractor shall be solely responsible for complying with the Contract Documents, as well as with Supplier instructions consistent with the Contract Documents, Owner's directions, and Laws and Regulations. Contractor is solely responsible for obtaining, correlating, confirming, and correcting dimensions at the Site; quantities; information and choices pertaining to fabrication processes; means, methods, sequences, procedures, and techniques of construction; safety precautions and programs incident thereto; and for coordinating the work of all trades.

Distribution: Contractor ☐ File ☐ Field ☐ Owner ☐ Other ☐

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SECTION 01 55 01S
TRAFFIC CONTROL, VEHICLE ACCESS AND PARKING

1.0 General	**Replace Clause 1.3 with the following:** .3S Unless alternative arrangements satisfactory to those adversely affected have been made by the Contractor, pedestrian and vehicular access to affected properties shall be maintained at all times.
1.2 Temporary Access Roads	**Replace Clause 1.2 with the following:** .2S Do not close any lanes of road or highway without approval of the Owner. Before re-routing traffic erect suitable signs and devices as approved by the Contract Administrator. Provide sufficient asphalt to ensure a smooth riding surface during work
1.4 Traffic Control	**Add the following Clause 1.4.14** .14S At a minimum for all roadways single lane alternating traffic shall be maintained at all times unless otherwise directed by the Contract Administrator. The Municipality will not control or direct the traffic control or direct the traffic control activities of the Contractor, but may require an immediate stop to any work where, in the Contract Administrator's opinion, the provided traffic control does not meet the requirements of the Agreement. The Contractor will prepare and submit a written Traffic Management Plan to the Resort Municipality of Whistler a minimum of ten (10) working days prior to commencement of any work affecting traffic. The Contractor will update and resubmit that plan for review as necessary for acceptance by the Municipality. A traffic management plan will be required for work for all of the project locations. Commencement of the Work shall not proceed unless a Traffic Management Plan acceptable to the Resort Municipality of Whistler is in place.

SECTION 01 55 13
VEHICULAR ACCESS AND PARKING

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for:

.1 Contractor's access to the Site.

.2 Contractor's use of existing access roads and parking areas.

.3 Maintenance of vehicle access roads and parking areas.

.4 Restoration.

.2 Scope:

.1 The Contractors use of the existing access road, gate restrictions and parking.

.3 Related Requirements:

.1 Include but are not necessarily limited to:

.1 Section 01 14 19 - Use of Site.

.2 Section 01 57 33 - Temporary Security.

.3 Section 01 71 33 - Protection of the Work and Property.

.4 Section 01 74 00 - Cleaning.

1.2 SUBMITTALS

Not Used

2. PRODUCTS – (NOT USED)

3. EXECUTION

3.1 USE OF EXISTING ACCESS ROADS AND PARKING AREAS

.1 Existing Access Roads and Parking Areas – General:

.1 Use of Existing Access Roads:

.1 Contractor is allowed to use Owner's existing access roads, starting on the Effective Date of the Contract and after complying with other Contract requirements relative to starting the Work at the Site.

.2 The existing Forestry Services Building is not used in the winter and access will only be required where requested by the RMOW. Spring, summer and fall access will be required.

.2 Existing Parking Areas for Use by Contractor:

.1 Contractor is allowed to use the existing parking stalls

.2 During winter months the Owner will utilize parking areas across from the work site (east side) for snow storage

.3 Restrictions:

.1 Prevent interference with traffic on existing access roads and parking areas. Always keep access roads and entrances serving the Site clear and available to Owner, and their respective employees, suppliers, and consultants; emergency vehicles; and other contractors.

.2 Do not use access roads or Site entrances for parking or storage of materials or equipment.

.3 Obey posted speed limits. If the Site has no posted speed limit, restrict traffic of Contractor's personnel, construction vehicles and equipment, deliveries, and haul-trucks to a maximum speed of 15 km/hr on the Site.

.4 Schedule deliveries to minimize the use of existing access roads and Site entrances.

.5 Use only rubber-tire vehicles on existing roads and parking areas. Do not use tracked (caterpillar-type) vehicles or equipment on existing pavement unless such pavement will be replaced by Contractor. Maintain existing pavement for safe access by Owner, facility manager (if other than Owner), and their respective employees, suppliers, and consultants; emergency vehicles; and other contractors.

.6 Remedy damage to existing access roads and parking areas caused by Contractor's operations.

.7 Coordinate with Owner's snow clearing activities at adjacent buildings.

.8 Equipment delivery which may impact access to the WWTP or P279 shall be coordinated in advance with the Owner to mitigate impacts.

.4 Contractor shall indemnify and hold harmless Owner, Engineer, and their respective consultants and subcontractors from expenses and losses caused by Contractor's operations over the existing access road.

3.2 MAINTENANCE OF VEHICLE ACCESS AND PARKING AREAS

.1 Maintenance of Existing Access Roads and Parking Areas Used by Contractor:

.1 Unless otherwise indicated in the Contract Documents, Owner will perform routine maintenance of access roads and parking areas, existing prior to the start of construction, during the Project. Contractor is responsible for dust control and cleaning existing paved areas used by Contractor.

.2 The Owner will provide snow management for the WWTP access road and the site access road up to P279.

.3 The Contractor will provide snow management around the worksite. The existing forestry building is not used in the winter and access will only be required on an as-needed basis.

.2 Cleaning and Dust Control – All Vehicle Access and Parking Used by Contractor:

.1 Cleaning:

.1 Clean paved surfaces over which construction vehicles, equipment, and machinery travel. Perform cleaning not less-often than indicated in Section 01 74 00 - Cleaning, or more frequently as directed by Engineer, by mechanical sweeping or other means acceptable to Engineer.

.3 Remedy of Damaged Existing Paving:

.1 Comply with Section 01 71 33 - Protection of the Work and Property, and other applicable provisions of the Contract Documents.

.2 Contractor shall indemnify and hold harmless Owner, facility manager (if other than Owner), Engineer, and their respective consultants and subcontractors from expenses and losses caused by Contractor's operations on offsite haul routes.

3.3 RESTORATION

.1 Restoration:

.1 Restore to preconstruction conditions existing roads, walks, and parking areas damaged by Contractor, subject to the approval of the owner of affected roads, walks, and parking areas. Remedy damage in accordance with Section 01 71 33 - Protection of the Work and Property, and other provisions of the Contract Documents.

END OF SECTION

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SECTION 01 57 33
TEMPORARY SECURITY

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for security during the Project.

.2 Site access security procedures.

.3 Personnel and vehicle identification requirements.

.4 Temporary security fencing.

.2 Scope:

.1 Contractor shall provide all labour, materials, equipment, tools, services, and incidentals necessary and required to comply with the requirements of this Section.

.2 Contractor is solely responsible for delays and costs incurred to comply with the requirements of this Section and security procedures at the Site.

.3 Comply with Section 01 71 33 - Protection of the Work and Property.

.3 Related Requirements:

.1 Include, but are not limited to:

.1 Section 01 71 33 - Protection of the Work and Property.

1.2 GENERAL PROVISIONS FOR SECURITY DURING THE PROJECT

.1 Security – General:

.1 Prior to Substantial Completion:

.1 Contractor shall safely guard all the Work, the Project, materials, equipment, and property from loss, theft, damage, and vandalism by any and all persons and cause, until Substantial Completion, unless otherwise agreed upon by Owner and Contractor.

.2 After Substantial Completion:

.1 Contractor's responsibility for security of the Work resumes after Substantial Completion when Contractor is at the Site performing punch list Work, correction of defective Work, or warranty Work. Such security responsibility is in effect only for the subject Work being performed, Contractor's construction equipment and machinery, tools, and property immediately adjacent to the active work areas.

.3 Costs for security required under this Section are Contractor's responsibility.

.4 Contractor is not eligible for additional Contract Time or additional compensation due to delays or unanticipated costs incurred by Contractor due to compliance with security requirements in effect at the time Bids were submitted or, if there were no Bids, as of the Effective Date of the Contract.

.5 Responsibility for Losses:

.1 Make no claim against Owner, facility manager (if other than Owner), Engineer, or their respective consultants and subcontractors for damage resulting from trespass, theft, vandalism, or other failures of Contractor's security obligations under the Contract.

.2 Remedy damage to property of Owner and others arising from failure to furnish adequate security.

.6 Provide temporary fencing as required to secure material not incorporated into the Work.

.2 Existing Security at the Site

.1 Contractor to keep all facilities locked.

.3 Restrictions:

.1 Contractor's personnel shall not access the Site outside normal working hours without the express knowledge of and consent of the Owner and Contractor.

1.3 SUBMITTALS

.1 Action Submittals:

.1 Submit the following:

.1 Shop Drawings:

.1 Temporary Fencing: Submit site plan drawings showing proposed locations and extent of temporary site security fencing used for protection of any material not incorporated into the Work and storage outside.

.2 Product Data:

.1 Temporary Fencing: Manufacturer's literature, specifications, and installation instructions for temporary site security fencing proposed.

1.4 CONTRACTOR'S SITE ACCESS AND SECURITY PROCEDURES

.1 Comply with Section 01 55 13 - Vehicular Access and Parking and 01 14 19 – Use of Site.

.2 Comply with Owner's security procedures and access restrictions at the Site throughout the Project. Comply with the following:

.1 Parking:

.1 Contractor and sub-contractor vehicles shall contain an identification on the vehicle or on the dashboard indicating that the parked vehicle is associated with the project

2. PRODUCTS

2.1 TEMPORARY FENCING

.1 Material Requirements:

.1 Temporary fencing shall not be damaged or have breaches.

.2 Provide other security fencing deemed necessary by Contractor, such as for Contractor's material and equipment storage areas. Such fencing, when not protecting Owner's or facility manager's property, shall be as deemed appropriate by Contractor for Contractor's purposes.

3. EXECUTION

3.1 TEMPORARY FENCING

.1 Installation:

.1 Provide temporary security for outdoor contractor storage of material not incorporated into the Work.

.2 Install temporary security fencing in accordance with the fence Supplier's instructions.

.2 Maintenance:

.1 Maintain temporary security fencing throughout the Project, until removal.

.2 Promptly repair damage to temporary security fencing and replace fencing when necessary to preserve security.

.3 Removal:

.1 Remove temporary security fencing when permanent site security fencing is in place and fully functional, or when otherwise acceptable to Engineer.

.2 Remove required temporary security fencing at Site perimeter and other temporary security fencing required by the Contract prior to inspection for Substantial Completion.

END OF SECTION

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SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Common requirements for materials and equipment.

.2 Compatibility of materials and equipment.

1.2 REQUIREMENTS FOR MATERIALS AND EQUIPMENT

.1 Unless otherwise indicated in the Contract Documents, furnish materials and equipment that:

.1 have not been previously incorporated into another project or facility; and

.2 have not changed ownership after initial shipment from the manufacturer's factory or facility; and

.3 if stored since their manufacture or fabrication, have, while in storage, been properly maintained and serviced in accordance with the manufacturer's recommendations for long-term storage; submit documentation as required by the Engineer that such maintenance and service has been performed; and

.4 that the item(s) have not been subject to degradation or deterioration since manufacture; and

.5 are the current model(s) or type(s) furnished by the Supplier.

.2 To the extent possible, furnish from a single source those materials and equipment that are of the same generic kind.

.3 Furnish materials and equipment complete with accessories, trim, finish, fasteners, and other items shown, indicated, or required for a complete installation for the indicated use and performance.

.4 Standard Items: When available, and unless the custom or nonstandard options are specified or indicated, furnish standard materials and equipment of types that have been produced and used successfully in similar situations on other projects.

.5 Visual Matching: Where required in the Contract Documents, furnish materials and equipment that match (as determined by Engineer) referenced existing construction and mock-ups and Sample(s) approved by Engineer.

1.3 COMPATIBILITY

.1 Similar materials and equipment by the same Supplier shall be compatible with each other unless otherwise indicated in the Contract Documents or approved by Engineer.

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 61 03
EQUIPMENT - BASIC REQUIREMENTS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Requirements of this Specification Section apply to all equipment provided on the Project including those found in other Divisions even if not specifically referenced in individual "Equipment" Articles of those Specification Sections.

.2 Related Sections include but are not necessarily limited to:

.1 Section 03 15 19 - Anchorage to Concrete.

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 09 96 00 - High Performance Industrial Coatings.

.4 Section 10 14 00 - Identification Devices.

.5 Section 26 05 09 - Motors.

.6 Section 26 29 23 - Variable Frequency Drives - Low Voltage.

.7 Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Bearing Manufacturers Association (ABMA).

.2 American Gear Manufacturers Association (AGMA).

.3 American Petroleum Institute

.1 API 686 - Recommended Practice for Machinery Installation and Installation Design

.4 ASTM International (ASTM):

.1 E1934, Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography.

.2 F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.5 Hydraulic Institute (HI):

.1 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.

.6 International Electrotechnical Commission (IEC).

.7 Institute of Electrical and Electronics Engineers, Inc. (IEEE).

.8 International Organization for Standardization (ISO):

.1 1940, Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances.

.2 21940-11, Mechanical Vibration - Rotor Balancing - Part 11: Procedures and Tolerances for Rotors with Rigid Behavior.

.9 National Electrical Manufacturers Association (NEMA):

.1 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 ICS 6, Enclosures for Industrial Control and System.

.3 MG 1, Motors and Generators.

.10 InterNational Electrical Testing Association (NETA):

.1 ATS, Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.

.11 Canadian Electrical Code

.12 Underwriters Laboratories, Inc. (ULc).

.1 508, Standard for Safety Industrial Control Equipment.

.2 508A, Standard for Safety Industrial Control Panels.

.3 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.

.13 Vibration Institute.

.2 Supplier's Vibration Analyst:

.1 Supplier's vibration analyst shall prepare pre-Shop Drawing vibration analysis of equipment.

.2 Where required, Supplier's vibration analyst shall be either equipment manufacturer's qualified employee or independent business entity whose sole business, or principal part of its business, is evaluating and determining natural frequencies of rotating equipment.

.3 Shall possess not less than 10 years' relevant experience.

.4 Supplier's Vibration Analyst's Professional Engineer:

.1 Vibration analysis shall be performed by, or under the direct, personal supervision of, professional engineer licensed and registered (in the same jurisdiction as the Site) experienced in preparing finite element analyses, rotordynamic analyses, and experimental modal analysis similar to that required for the Work.

.2 Professional engineer shall possess not less than five years' combined experience in field testing and data analysis for vibration analysis.

.3 Vibration analysis professional engineer's seal and signature, with indication of date seal and signature were applied to the subject document, shall clearly appear on all results and reports furnished as Submittals.

.3 Field Vibration Testing Subcontractor:

.1 Field vibration testing Subcontractor shall, where required by the Contract Documents, perform vibration testing of equipment installed at the Site and perform associated vibration analyses.

.2 Vibration testing Subcontractor shall be an independent entity that has performed as its sole business, or principal part of its business, for not less than 10 years, inspection, testing, calibrating, adjusting equipment and systems, and performing vibration testing of equipment.

.3 Entities whose principal business is one or more of the following are not considered independent vibration testing entities and, therefore, shall not be field vibration testing Subcontractor:

.1 Motor sales, service, or repairs.

.2 Process equipment sales, service, or repairs.

.4 Field vibration testing Subcontractor must have an established program for monitoring and testing equipment calibration,

.5 Field Personnel: Each person employed for field vibration testing on the Work shall possess not less than the following qualifications:

.1 Three years' field experience covering all phases of field vibration testing and data gathering.

.2 Current, valid Vibration Category II certification from Vibration Institute or a licensed, registered professional engineer

.6 Analysis Personnel: Personnel performing analysis for field vibration testing Subcontractor shall possess not less than the following qualifications:

.1 Five years' combined field testing and data analysis experience.

.2 Current, valid Vibration Category III certification from the Vibration Institute or a professional engineer

.7 Analysis Equipment: Field vibration testing Subcontractor shall have access to and use, where appropriate, the following testing equipment, properly maintained and calibrated:

.1 Impact Hammer:

.1 Frequency Range: 1 kHz.

.2 Range (5v output) 5,000 pounds-force (22,200 newtons).

.3 Hammer sensitivity (approx.) 1mV/lbf (0.23 mV/N)

.2 Analyzer:

.1 Frequency Range: 1 Hz to 10,000Hz.

.2 Frequency Accuracy: 0.02 percent.

.3 Non-Integrated Spectral Amplitude Accuracy: 5 percent, 3 Hz to 65 Hz.

.4 Single Integrated Spectral Amplitude Accuracy: 5 percent, 10 Hz to 20 Hz.

.5 Supports measurements of acceleration, velocity, and displacement.

.3 Vibration Sensor:

.1 Sensitivity: ±5 percent = 100 mV/g

.2 Acceleration Range: ±5 g.

.3 Amplitude Nonlinearity: ±1 percent

.4 Frequency Response: ±10Hz to 7kHz (±3 dB)

.4 Data logging equipment for simultaneous recording of the following data points:

.1 Vibration in the X, Y, and axial planes (for all pumps pursuant to ANSI/HI Standard).

.2 Digital tachometer recording RPM.

.3 Discharge Pressure Transmitter

.1 Accuracy: 0.3 percent of range

.2 Fluid Temperature Range: 32 to 100 DegF

.4 Suction Pressure Transmitter (when other than submersible pump or vertical turbine (suspended) pump.

.1 Accuracy 0.35 percent of range.

.2 Fluid Temperature Range: 32 to 100 DegF.

.3 For submersible pumps and vertical turbine (suspended) type pumps, suction liquid surface level signal from Site's monitoring and control system (e.g., plant PLC/SCADA system).

.5 For pumps, pumping rate (flow) signal from Site's monitoring and control system (e.g., plant PLC/SCADA system)

.6 Equipment/motor bearing temperature signal from Site's monitoring and control system (e.g., plant PLC/SCADA system)).

.7 Pump/motor vibration signal from Site's monitoring and control system (e.g., plant PLC/SCADA system).

.4 Infrared Thermography Testing Program:

.1 Testing firm:

.1 An independent firm performing, as the sole or principal part of its business for a minimum of 10 years, the inspection, testing, calibration, and adjusting of systems.

.2 Must have an established monitoring and testing equipment calibration program with accuracy traceable in an unbroken chain,

.2 Field personnel:

.1 Minimum of one year field experience covering all phases of field thermography testing and data gathering.

.3 Analysis personnel:

.1 Minimum three years combined field testing and data analysis experience.

.5 Electrical Equipment and Connections Testing Program:

.1 Qualification requirements as specified in section 26 08 13 - Acceptance Testing.

.6 Miscellaneous:

.1 A single manufacturer of a "product" shall be selected and utilized uniformly throughout Project even if:

.1 More than one manufacturer is listed for a given "product" in Specifications.

.2 No manufacturer is listed.

.2 Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific CEC requirements related to area classification.

.3 Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and verify their compatibility.

1.3 DEFINITIONS

.1 Product: Manufactured materials and equipment.

.2 Major Equipment Supports - Supports for Equipment:

.1 Located on or suspended from elevated slabs with supported equipment weighing 1000 kg or greater, or;

.2 Located on or suspended from roofs with supported equipment weighing 250 kg or greater, or;

.3 Located on slab-on-grade or earth with supported equipment weighing 2500 kg or more.

.3 Equipment:

.1 One or more assemblies capable of performing a complete function.

.2 Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.

.3 Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

.4 Installer or Applicator:

.1 Installer or applicator is the person actually installing or applying the product in the field at the Project site.

.2 Installer and applicator are synonymous.

.5 Baseplate or equipment base plate or machine base

.1 Are fabricated frames of structural shapes and plates with enough strength and sturdiness to serve as the surface to which other equipment is attached to and supported by. Baseplates can be directly mounted and grouted to concrete equipment support bases or machined and bolted to a sole plate.

.6 Sole plate

.1 A thick steel machined plate that is attached to and grouted to a concrete equipment support base.

.2 Base plates are bolted to a sole plate when a sole plate is specified and/or provide.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 General for all equipment:

.1 Data sheets that include manufacturer's name and complete product model number.

.1 Clearly identify all optional accessories that are included.

.2 Acknowledgement that products submitted comply with the requirements of the standards referenced.

.3 Manufacturer's delivery, storage, handling, and installation instructions.

.4 Equipment identification utilizing numbering system and name utilized in Drawings.

.5 Equipment installation details:

.1 Location of anchorage.

.2 Anchorage setting templates.

.3 Manufacturer's installation instructions.

.6 Equipment area classification rating.

.7 Shipping and operating weight.

.8 Equipment physical characteristics:

.1 Dimensions (both horizontal and vertical).

.2 Materials of construction and construction details.

.9 Equipment factory primer and paint data.

.10 Manufacturer's recommended spare parts list.

.11 Equipment lining and coatings.

.12 Equipment utility requirements include air, natural gas, electricity, and water.

.13 Ladders and platforms provided with equipment:

.1 Certification that all components comply fully with OSHA requirements.

.2 Full details of construction/fabrication.

.3 Scaled plan and sections showing relationship to equipment.

.2 Mechanical and process equipment:

.1 Operating characteristics:

.1 Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.

.2 Brake horsepower requirements.

.3 Copies of equipment data plates.

.2 Piping and duct connection size, type and location.

.3 Equipment bearing life certification.

.4 Equipment foundation data:

.1 Equipment center of gravity.

.2 Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.

.3 Type, size, and materials of construction of anchorage.

.4 Data required by Section 03 15 19 Anchorage to Concrete for anchor rod design.

.3 Electric motor:

.1 Motor manufacturer and model number.

.2 Complete motor nameplate data.

.3 Weight.

.4 NEMA design type.

.5 Enclosure type.

.6 Frame size.

.7 Winding insulation class and temperature rise.

.8 Starts per hour.

.9 Performance data:

.1 Motor speed-torque curve superimposed over driven machine speed-torque curve during start-up acceleration and at rated terminal voltage a minimum permissible or specified terminal voltage for all motors over 30 HP.

.2 Time-current plots with acceleration versus current and thermal damage curves at the operating and ambient temperatures and at rated terminal voltage and minimum permissible or specified terminal voltage for all motors over 30 HP.

.3 Guaranteed minimum efficiencies at 100 percent, 75 percent, and 50 percent of full load.

.4 Guaranteed minimum power factor at 100 percent, 75 percent, and 50 percent of full load.

.5 Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.

.6 Starting, full load, and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.

.10 Bearing data and lubrication system.

.11 Natural frequency calculations for:

.1 Completed assembly including but not limited to the equipment base, rotating piece of equipment, and the rotating piece of equipment driver.

.2 Individual piece of rotating equipment.

.3 Equipment driver and connected gear reducer, if applicable.

.12 Thermal protection system including recommended alarm and trip settings for winding and bearing RTD's.

.13 Fabrication and/or layout drawings:

.1 Dimensioned outlined drawing.

.2 Connection diagrams including accessories (strip heaters, thermal protection, etc.).

.14 Certifications:

.1 When utilized with a reduced voltage starter, certify that motor and driven equipment are compatible.

.2 When utilized with a variable frequency controller, certify motor is inverter duty and the controller and motor are compatible.

.1 Include minimum speed at which the motor may be operated for the driven machinery.

.15 Electrical gear:

.1 Unless specified in a narrow-scope Specification Section, provide the following:

.1 Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.

.2 Control panels:
.1 Panel construction.
.2 Point-to-point ladder diagrams.
.3 Scaled panel face and subpanel layout.
.4 Technical product data on panel components.
.5 Panel and subpanel dimensions and weights.
.6 Panel access openings.
.7 Nameplate schedule.
.8 Panel anchorage.
.9 Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70. Include any required calculations.

.4 Systems schematics and data:
.1 Provide system schematics where required in system specifications.
.1 Acknowledge all system components being supplied as part of the system.
.2 Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
.3 Provide technical data for each system component showing compliance with the Contract Document requirements.
.4 For piping components, identify all utility connections, vents and drains which will be included as part of the system.

.5 For factory painted equipment, provide paint submittals in accordance with Section 09 96 00.

.6 Qualifications for:
.1 Natural frequency analysis firm and personnel.
.2 Vibration testing firm and personnel.
.3 Infrared thermography testing firm and personnel.
.4 Electrical equipment and connections testing firm and personnel.

.7 Equipment Monitoring and Testing plans, in accordance with PART 3 of this Specification Section:
.1 Natural frequency analysis and calculations.
.2 Vibration testing.
.3 Thermography testing.
.4 Electrical equipment and connection testing.

.2 Factory Test Reports:
.1 Natural frequency bump test reports where required for rotating equipment.
.1 Minimum characteristics of impact hammer.

.1 Frequency Range 1 kHz.
.2 Range (5v output) 5,000 pounds-force (22,200 N).
.3 Hammer Sensitivity (7pprox.) 1 mV/lbf (0.23 mV/N).
.4 Resonant Frequency 12 kHz

.2 Motor, equipment and final assembled equipment including motor.
.1 Determine natural frequency of assembled motor prior to shipping to equipment manufacturer or job site.
.1 Individual motor fastened to an “infinitely rigid” mass at the same bolt circle as the final assembled equipment.
.2 Determine natural frequency of the pump.
.1 Pump fastened to an “infinitely rigid” mass at the same bolt circle as the final assembled equipment.
.3 Determine natural frequency of the pump/motor assembly.
.1 Pump/motor assembly fastened to an “infinitely rigid” mass at the same bolt circle as the final field assembled equipment.
.4 For this use, the "infinitely rigid" mass shall be at least 10 times the weight of the equipment being tested.
.3 Submit natural frequency report(s) for approval prior to shipment.
.4 Equipment performance tests.
.1 As listed in individual equipment specifications.

.3 Contract Closeout Information:
.1 Operation and Maintenance Data:
.1 See Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

.4 Informational Submittals:
.1 Notification, at least one week in advance, that testing will be conducted at factory.
.2 Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.
.3 Submit sample Manufacturer's Field Service Report (MFSR). Report shall use manufacturer’s standard report or use the form in the Exhibits and have at least the following information:
.1 Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.

.2 Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.

.3 Motor test reports.

.4 Field noise testing reports if such testing is specified.

.5 Preliminary field quality control testing format to be used as a basis for final field quality control reporting.

.6 Provide three bound final written reports documenting natural frequency testing, vibration monitoring and testing for specified equipment.

.1 Include the acceptance criteria of all equipment tested.

.2 Provide individual tabbed sections for information associated with each piece of tested equipment.

.7 Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.

.8 Testing and monitoring reports in accordance with PART 3 of this Specification Section.

.9 Certification that driven equipment and VFD are compatible.

.4 Submit completed Manufacturer's Field Service Report (MFSR) for each piece of equipment supplied.

2. PRODUCTS

2.1 MOTORS

.1 Refer to Electrical

2.2 ACCESSORIES

.1 Guards:

.1 Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting WorksafeBC requirements.

.2 Interior applications:

.1 Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.

.2 Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 inches spacing.

.3 Connect to equipment frame with hot-dip galvanized bolts and wing nuts.

.3 Exterior applications:

.1 Construct from 16 GA stainless steel or aluminum.

.2 Construct to preclude entrance of rain, snow, or moisture.

.3 Roll to conform to shaft or coupling surface.

.4 Connect to equipment frame with stainless steel bolts and wing nuts.

.2 Anchorage:

.1 Cast-in-place anchorage:

.1 Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.

.2 Configuration and number of anchor bolts shall be per manufacturer's recommendations.

.3 Provide two nuts for each bolt.

.2 Drilled anchorage:

.1 Adhesive anchors per Section 03 15 19.

.2 Threaded rods same as cast-in-place.

.3 Data Plate:

.1 Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.

.2 Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

.4 Gages:

.1 Provide gages in accordance with Section 26 29 04.

.2 Provide at the following locations:

.1 Inlet and outlet of all reciprocating, centrifugal and positive displacement mechanical and process equipment.

.2 At locations identified on Drawings.

.3 At locations specified in Section 26 29 04.

.3 Utilize tapping sleeves for mounting per Section 40 05 00.

.5 Lifting Eye Bolts or Lugs:

.1 Provide on all equipment 25 kg or greater.

.2 Provide on other equipment or products as specified in the narrow-scope Specification Sections.

.6 Platforms and Ladders:

.1 Design and fabricate in accordance with WorksafeBC Standards.

.2 Fabricate components from galvanized steel.

.3 Provide platform surface: Non-skid grating, unless specified in narrow-scope Specification Sections.

2.3 FABRICATION

.1 Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

.2 Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.

.3 Furnish like parts of duplicate units to be interchangeable.

.4 Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.

.5 Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.

.1 Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.

.6 Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.

.1 Provide drain connection for 3/4 inches PVC tubing.

.7 Machine the mounting feet of rotating equipment.

.8 Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that cannot be properly prepared and painted.

.1 When such back to back fabrication cannot be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.

.9 Natural frequency/critical Speed:

.1 All rotating parts accurately machined and in as near perfect rotational balance as practicable.

.2 Excessive vibration is sufficient cause for equipment rejection.

.3 Ratio of all rotative speeds to natural frequency/critical speed of a unit or components: Greater than 1.2.

.10 Equipment Base

.1 Adequate grout and vent openings to allow grout to flow under entire base.

.11 Control Panels Engineered and Provided with the Equipment by the Manufacturer:

.1 Manufacturer’s standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.

.2 NEMA rated components are acceptable, whichever is used in the manufacturer's standard engineered design, unless specific requirements are required in the specific equipment Specification Section.

.3 Affix entire assembly with a ULc 508A or ULc 698A label "Listed Enclosed Industrial Control Panel" prior to delivery.

.1 Control panels without an affixed ULc 508A or ULc 698A label shall be rejected.

.4 Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.

.1 Determine the SCCR rating by one of the following methods:

.1 Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.

.2 Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.

.3 Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.

.2 The source equipment is the switchboard, panelboard, motor control center or similar equipment where the control panel circuit originates.

.3 For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

2.4 SHOP OR FACTORY PAINT FINISHES

.1 Electrical Equipment:

.1 Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Section 09 96 00 to receive field painting.

.1 Field painted equipment: See Section 09 96 00 for factory applied primer/field paint compatibility requirements.

.2 Field paint other equipment in accordance with Section 09 96 00.

.1 See Section 09 96 00 for factory applied primer/field paint compatibility requirements.

2.5 SOURCE QUALITY CONTROL

.1 Motor Tests:

.1 Test motors in accordance with NEMA and IEEE standards.

.2 Provide routine test for all motors.

.3 The Owner reserves the right to select and have tested, either routine or complete, any motor included in the project.

.1 The Owner will pay all costs, including shipping and handling, for all motors successfully passing the tests.

.2 Pay all costs, including shipping and handling, for all motors failing the tests.

.3 If two successive motors of the same manufacturer fail testing, the Owner has the right to reject all motors from that manufacturer.

.2 Balance:

.1 Unless specified otherwise, for all equipment 10 hp or greater, all rotating elements in motors, pumps, blowers, and centrifugal compressors shall be fully assembled, including coupling hubs, before being statically and dynamically balanced. Balance all rotating elements to the following criteria, per ISO 21940-11:

$$Uper = \frac{G\ x\ 6.015\ x\ W/2}{N}$$

Where:

Uper = Permissible residual unbalance for each correction plane in ounce-inches (OZ-IN). See ISO 21940-11 for acceptable values.

G = ISO Balance Quality Grade Number, per ISO 21940-11

W = Rotor weight in pounds

N = Maximum continuous operating RPM

.1 Where specified, balancing reports, demonstrating compliance with this requirement, shall be submitted as product data.

3. EXECUTION

3.1 INSTALLATION

.1 Install equipment as shown on the Drawings and other Contract Documents, in accordance with manufacturer's written instructions, and in accordance with Laws and Regulations. Where the Contract Documents, manufacturer’s written instructions, or Laws and Regulations conflict, obtain interpretation or clarification from Engineer before proceeding.

.2 Utilize appropriate templates for anchorage placement for equipment installed on concrete.

.3 Equipment Drainage Discharges:

.1 For equipment having drainage requirements, such as seal water, provide 3/4-inch copper, PVC, or clear plastic tubing from drainage discharge at equipment base to nearest floor drain or equipment drain. Do not discharge liquid across floors.

.2 Furnish and install bell up at each equipment base.

.3 Route equipment drainage piping clear of major traffic areas, to discharge to locations approved by Engineer. To extent practical, avoid creating tripping hazards.

.4 Coordination of Equipment Supports and Bases with Structures:

.1 Do not construct foundations until major equipment supports are approved by Engineer.

.5 Equipment Lubrication Points:

.1 Extend all non-accessible or difficult-to-access lubrication fittings to reasonably accessible locations to facility operation and maintenance personnel without use of ladders or elevating devices, by providing stainless steel tubing (of appropriate wall thickness for the service and application) to a location which allows easy access of fittings from closest operating floor level.

.6 Concrete Equipment Support Bases:

.1 Install level in both directions, with acceptable vertical tolerance of 1/4-inch±.

.2 At anchorage locations, install bases flat and level.

.7 Machine Bases / Sole Plates:

.1 Grease or tape anchorages and jack screws to inhibit grout from adhering to bolts and other anchors.

.1 Jack screws number and size by equipment manufacturer.

.1 Jack screw

.1 304 Stainless Steel minimum

.2 0.5 inches diameter minimum

.2 Jack Screw Pad

.1 2 inch diameter minimum

.2 Anchored in place with a structural epoxy adhesive.

.2 Install machine base of rotating equipment on equipment base.

.3 Level in both directions using jack screws, with a machinist level, according to machined surfaces on base. Base shall be level within vertical tolerance of the lesser of (a) 0.005 inch per foot with no more than 0.0005 inches difference between any two points, or (b) equipment manufacturer's written instructions.

.4 Level machine base on equipment base and align couplings between driver and driven equipment.

.8 Couplings for Rotating Equipment:

.1 Align in annular and parallel positions.

.1 For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 inch tolerance for couplings four-inch size and smaller.

.2 Couplings larger than four-inch size: Increase tolerance 0.0005 inch per inch of coupling diameter above four-inch; for example: for six-inch coupling, tolerance is 0.002 inch. For 10 inch coupling, required tolerance is 0.004 inch.

.3 For equipment rotating at speeds greater than 1200 rpm, tolerance for both annular and parallel positions shall be rate of 0.00025 inch (or less) per inch of coupling diameter.

.2 If equipment is furnished by manufacturer as mounted unit , verify factory alignment after installation at the Site. Realign if as necessary, in accordance with equipment manufacturers' written instructions, to provide required factory tolerance..

.3 Inspect surfaces for runout before attempting to trim or align units.

.9 Grouting:

.1 Level onto equipment base with jack screws in accordance with the Contract Documents, provide a dam or formwork around base to contain grout between equipment base and equipment support pad.

.2 Preparation:

.1 Extend dam or formwork to cover leveling shims and blocks.

.2 Anchor sleeves:

.1 Required for equipment (Pumps, Mixers, Blowers) greater than 50 hp

.2 If anchor sleeves were used, fill voids in anchor sleeves with foam or room temperature vulcanizing (RTV) silicone to keep grout from filling sleeves.

.3 Do not use nuts below the machine base to level the unit.

.4 Saturate top of roughened concrete surface with water before grouting.

.3 Grout Installation:

.1 Install grout until entire space under machine base is completely filled to underside of base. Voids are unacceptable.

.2 Puddle grout by working a stiff wire through the grout and vent holes, to ensure grout is installed properly and to release air entrained in grout or base cavity.

.4 After Grout Installation:

.1 When grout is sufficiently hardened, remove dam or formwork and finish exposed grout surface to fine, smooth surface.

.2 Completely cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too-rapid evaporation of water from grout.

.3 Check for voids by tapping along the top deck of the mounting plate. A solid thud indicates grout-filled areas while a drum-like hollow sound indicates a void requiring filling.

.1 Void areas are to be filled by drilling 1/8 inches NPT holes in opposite corners of each void area. Grout to be pumped into one void with a grout gun until grout emerges from the other vent hole.

.4 When grout is fully hardened (after not less than seven days), remove jack screws, and tighten nuts on anchor bolts and similar anchors to required torque.

.5 Inspect and verify levelness of machine base and, if not in accordance with requirements, remedy by removing base and reinstalling in accordance with the Contract Documents.

.6 Inspect driver-driven equipment for proper alignment. When not in accordance with requirements, remedy so that the Work is not defective.

3.2 INSTALLATION CHECKS

.1 For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.

.1 In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.

.2 Secure from equipment manufacturer's representative(s) a written report certifying that equipment:

.1 Has been properly installed and lubricated.

.2 Is in accurate alignment.

.3 Is free from any undue stress imposed by connecting piping or anchor bolts.

.4 Has been operated under full load conditions and that it operated satisfactorily.

.1 Secure and deliver a field written report to Owner immediately prior to leaving jobsite.

.3 No separate payment shall be made for installation checks.

.1 All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

.1 Identify equipment and install hazard warning signs in accordance with Section 10 14 00.

3.4 FIELD PAINTING AND PROTECTIVE COATINGS

.1 For required field painting and protective coatings, comply with Section 09 96 00, High Performance Industrial Coatings.

3.5 WIRING CONNECTIONS AND TERMINATION

.1 Clean wires before installing lugs and connectors.

.2 Coat connection with oxidation eliminating compound for aluminum wire.

.3 Terminate motor circuit conductors with copper lugs bolted to motor leads.

.4 Tape stripped ends of conductors and associated connectors with electrical tape.

.1 Wrapping thickness shall be 150 percent of the conductor insulation thickness.

.5 Connections to carry full ampacity of conductors without temperature rise.

.6 Terminate spare conductors with electrical tape.

3.6 FIELD QUALITY CONTROL

.1 General:

.1 Furnish equipment manufacturer's field quality control services and testing as specified in the individual equipment Specification Sections.

.2 Execute pre-demonstration requirements in accordance with Section 01 75 00.

.3 Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.

.4 Provide testing for all equipment furnished or installed as part of the Work.

.5 Repair or replace equipment shown to be out of range of the acceptable tolerance until the equipment meets or exceeds acceptable standards.

.6 Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:

.1 Contract Drawings and Specifications.

.2 Related construction change documentation.

.3 Approved Shop Drawings.

.4 Approved Operation and Maintenance Manuals.

.5 Other pertinent information as required.

.2 Equipment Monitoring and Testing Plans:

.1 Approved in accordance with Shop Drawing submittal schedule.

.2 Included as a minimum:

.1 Qualifications of firm, field personnel, and analysis personnel doing the Work.

.2 List and description of testing and analysis equipment to be utilized.

.3 List of all equipment to be testing, including:

.1 Name and tag numbers identified in the Contract Documents.

.2 Manufacturer's serial numbers.

.3 Other pertinent manufacturer identification,

.3 Instruments Used in Equipment and Connections Quality Control Testing:

.1 Minimum calibration frequency:

.1 Field analog instruments: Not more than 6 months.

.2 Field digital instruments: Not more than 12 months.

.3 Laboratory instruments: Not more than 12 months.

.4 If instrument manufacturer's calibration requirements are more stringent, those requirements shall govern.

.2 Carry current calibration status and labels on all testing instruments.

.3 See individual testing programs for additional instrumentation compliance requirements.

.4 Testing and Monitoring Program Documentation:

.1 Provide reports with tabbed sections for each piece of equipment tested.

.2 Include all testing results associated with each piece of equipment under that equipment's tabbed section.

.1 Include legible copies of all forms used to record field test information.

.3 Prior to start of testing, submit one copy of preliminary report format for Engineer review and comment

.1 Include data gathering and sample test report forms that will be utilized.

.4 In the final report, include as a minimum, the following information for all equipment tested:

.1 Equipment identification, including:

.1 Name and tag numbers identified in the Contract Documents.

.2 Manufacturer's serial numbers.

.3 Other pertinent manufacturer identification,

.2 Date and time of each test.

.3 Ambient conditions including temperature, humidity, and precipitation.

.4 Visual inspection report.

.5 Description of test and referenced standards, if any, followed while conducting tests.

.6 Results of initial and all retesting.

.7 Acceptance criteria.

.8 "As found" and "as left" conditions.

.9 Corrective action, if required, taken to meet acceptance.

.10 Verification of corrective action signed by the Contractor, equipment supplier, and Owner's representative.

.11 Instrument calibration dates of all instruments used in testing.

.5 Provide three (3) bound final reports prior to Project final completion.

.5 Electrical Equipment and Connections Testing Program:

.1 Perform testing on Electrical equipment, connections, and motors in accordance with 26 08 13 - Acceptance Testing.

.6 Other Testing:

.1 Perform tests and inspections not specifically listed but required to assure equipment is safe to energize and operate.

.2 Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs, and cross members that are cast, welded, or bolted shall be tested for a natural frequency of vibration after equipment is mounted.

.1 The ratio of the natural frequency of the structure to the frequency of the disturbing force shall not be between 0.5 and 1.5.

.7 Infrared Thermography Testing Program:

.1 Perform infrared thermography testing for equipment specified in other Divisions during the Equipment Demonstration Period.

.1 Perform on all rotating and reciprocating equipment having drivers 25 hp or greater.

.2 Additional requirements for infrared thermography monitoring and testing equipment:

.1 Temperature range: -10 to 350 degrees C.

.2 Accuracy: ±2 percent or 2 degrees C, whichever is greater.

.3 Repeatability: ±1 percent or 1 degree C, whichever is greater.

.4 Temperature indication resolution: 0.1 degrees C.

.5 Minimum focus distance: 0.3 meters.

.6 Output in color palettes: JPEG, BMP, or other digital format compatible with Windows.

.3 Perform inspection per ASTM E1934.

.1 Operate VFD driven equipment at 100 percent speed during thermographic inspection.

.4 Acceptability of electrical connections and components based on temperature comparison between components and ambient air temperatures not greater than 10 degrees C per ASTM E1934.

.5 Acceptability of motors and equipment bearings based on temperature rise not greater than 5 DEGC above the equipment and/or bearing manufacturers published criteria.

.8 Equipment Field Vibration Monitoring and Testing Program:

.1 Perform vibration monitoring and testing for equipment specified in other Divisions during the Equipment Demonstration Period.

.2 Perform field vibration testing on each item of rotating and reciprocating equipment having driver 50HP and greater

.3 Acceptability of equipment conditions, except pumps, based on ISO 1940-1 Balance Quality Grade G6.3 criteria.

.4 Acceptability of pumping equipment to be based on current ANSI/HI criteria:

.1 ANSI/HI 11.6-2012 for Submersible Pumps in a Wet-pit or Dry-pit configuration.

.2 ANSI/HI 9.6.4-2016 for all other centrifugal pumps.

.5 Utilize an Engineer approved 3rd party testing agency to perform vibration monitoring and testing on equipment.

.6 For variable speed equipment provide vibration testing at no more than 3 percent increments of maximum speed throughout entire operating range.

.7 Provide machinery condition diagnosis based on an acceptable machinery vibration severity guide or machinery fault guide analysis provided by the testing agency.

.8 Tolerances for pumping equipment shall be per HI published standards.

.9 Repair or replace equipment shown to be out of range of the specified tolerance until the equipment meets the specified normal operation range required in the machinery fault guide analysis.

.10 Document testing with written report.

.1 Report to include initial testing results, acceptance criteria, corrective action taken to meet acceptance, verification of corrective action and acceptance report and baseline.

.2 Natural frequency of installed equipment utilizing an impact hammer.

.3 Report to include graphical plots of vibration signature for each test point at a scale which illustrates all vibration levels greater than 0.025 ips RMS.

3.7 DEMONSTRATION

.1 Demonstrate equipment in accordance with Section 01 75 00.

3.8 ABBREVIATION TABLE

.1 As indicated on the Drawings.

3.9 CLOSEOUT ACTIVITIES

.1 Refer to Section 01 81 33 – Cyber-Security Requirements for cyber security related closeout requirements.

END OF SECTION

EXHIBIT A

MANUFACTURER FIELD SERVICE REPORT

This field service report is generic in nature. An electronic copy of this form will be furnished upon request from the Engineer. This report is to reflect that all requirements of the Operations and Maintenance Manual and the individual equipment specification requirements have been performed for the installation and operation and also to provide a baseline for amperage draw for each phase, vibration readings, rotation, alignment and all other applicable tests required to insure that the equipment has been installed properly. A MFSR will be required for each individual piece of equipment requiring a MFSR.

Definitions of Reports:

Initial service report: Required for construction preparations. Equipment delivered to site is in good condition and conforms to specification requirements. Anchor bolts, hardware and ancillary items (piping, flanges, conduits, fuel/power supply) are compatible with equipment.

Interim service report: Required for equipment installation onto base or foundation. Piping connections, electrical and control connections or structural attachment are complete. For equipment stored on site over four weeks, interim service report will document that manufacturer's long-term storage procedures have been incorporated and equipment has not been damaged, nor coatings deteriorated.

Final service report is to be completed when equipment can be started, electrical amperage and voltage draw measured, cold and hot alignments performed, vibration testing and monitoring performed and the equipment is found to be in compliance with Manufacturer's operating parameters and the requirements of the individual equipment specifications.

PROJECT: _____

Report Status:

Initial Service Report completed and submitted on _____

Interim Service Report completed and submitted on _____

Final Service Report completed and submitted on _____

Commencement of Warranty _____

I Description

A. Equipment Name and Identification: _____

_____

B. Serial Number: _____

C. Specification Section Number: _____

D. Manufacturer: _____

E. Representative: _____

F. Type of Service: Initial (_____) Interim (_____) Final (_____)

II General Review

A. The above referenced equipment/material/supplies have been inspected, checked, and adjusted. Yes (_____) No (_____)

Summary: _____

_____

B. The above referenced equipment/material/supplies were placed upon properly prepared or suitable substrate. N/A (_____) Yes (_____) No (_____)

Summary: _____

_____

C. The above referenced equipment/material/supplies are free from any undue stress imposed by any connected piping, anchor bolts or any other load. N/A (_____) Yes (_____) No (_____)

Summary: _____

_____

D. The above referenced equipment/material/supplies have operated under design conditions. N/A (_____) Yes (_____) No (_____)

Summary: _____

_____

E. The above referenced equipment/material/supplies have been installed in accordance with the manufacturer's recommendations and the Procurement Documents, require no corrective work, and are hereby approved. Yes (_____) No (_____)

Summary: _____

_____

F. The above referenced equipment/material/supplies are acceptable to the manufacturer as installed providing the following corrective action(s) are performed:

1. _____
2. _____
3. _____
4. _____
5. _____

III Inspection Checklist

Item	Acceptable (Yes/No)	Readings/Comments
Bearings (1)		
Belts (tension reading)		

Item	Acceptable (Yes/No)	Readings/Comments
Lubrication Levels		
Vibration (1) (2) (MILS/SEC)		
Infrared Thermography (1) (2)		
Starting AMPS		
Full Load AMPS		
Volts		
Rotation		
Jacket Temperature (DEGF)		
Seal Water Flow Rate (GPH or GPM)		
Seal Water Pressure (PSI)		
O-rings/Packing		
Alignment (1)		
Anchor Bolts		
Anchor Bolt Torque		
Grout		
Substrate Approval		
Sound level (4 feet from unit) (1) (dB)		
Other		

(1) Inspection or testing reports must be attached.
(2) Provide vibration testing and monitoring procedures for Engineer's review and approval prior to testing.

IV O&M Manuals

A. The O&M manual as presented contains all information required for proper operation, maintenance, and instruction of this system. N/A (_____) Yes (_____) No (_____)

Summary: _____

_____

V Preventive Maintenance

A. The preventive maintenance summary outlined in the O&M manual is acceptable for operation of the system throughout the warranty period. N/A (_____) Yes (_____) No (_____)

Summary: _____

_____

VI Operator Training/Classroom Instruction

A. Training and instruction have been performed in accordance with the requirements of the Procurement Documents. N/A (_____) Yes (_____) No (_____)

B. Final Training/Classroom Instruction Completed on: _____

Summary: _____

_____

VII Remarks

_____

_____

_____

VIII Certification

I hereby certify, that I, (_____), am a duly authorized representative of the manufacturer, that I am empowered by the manufacturer to inspect, approve, and operate his equipment, and that I am authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as modified herein. I also certify that all information contained herein is true and accurate.

By: _____
(Authorized Representative)

For: _____

Date: _____

IX Acknowledgments

By: _____

For: _____
(Contractor)

Date: _____

By: _____

For: _____
(Engineer)

Date: _____

SECTION 01 65 50
PRODUCT DELIVERY, STORAGE, AND HANDLING

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Scheduling of product delivery.
- .2 Packaging of products for delivery.
- .3 Protection of products against damage from:
  - .1 Handling.
  - .2 Exposure to elements or harsh environments.

.2 Payment:
- .1 No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved Shop Drawings.
  - .1 Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

1.2 DELIVERY

.1 Scheduling: Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.

.2 Packaging: Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

.3 Identification: Clearly and fully mark and identify as manufacturer, item, and installation location.

.4 Protection and Handling: Provide manufacturer's instructions for storage and handling.

2. PRODUCTS - (NOT USED)

3. EXECUTION

3.1 PROTECTION, STORAGE AND HANDLING

.1 Manufacturer's Instruction:
- .1 Protect all products or equipment in accordance with the manufacturer's written directions.
  - .1 Store products or equipment in location to avoid physical damage to items while in storage.
  - .2 Handle products or equipment in accordance with manufacturer's recommendations and instructions.
- .2 Protect equipment from exposure to elements and keep it thoroughly dry.

.3 Protect all stainless steel products from exposure to iron.

3.2 STORAGE FACILITIES

.1 Temporary Storage Enclosure:

.1 Provide a weatherproof temporary storage enclosure specifically for the purpose of providing the protection of products and equipment.

.1 Size building to accommodate anticipated storage items.

.2 Provide methods of storage of products and equipment off the ground.

3.3 FIELD QUALITY CONTROL

.1 Inspect Deliveries:

.1 Inspect all products or equipment delivered to the site prior to unloading.

.1 Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on Project.

END OF SECTION

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SECTION 01 71 33
PROTECTION OF THE WORK AND PROPERTY

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for protecting the Work and property, including:

.1 Accessing or entering the property.

.2 Temporary barricades and temporary warning lights and signs.

.3 Responsibility to remedy damaged property.

.4 Protecting natural habitats, including trees, plants, lawns and meadows, and wildlife.

.5 Protecting Underground Facilities.

.6 Protecting existing surface structures.

.7 Protecting floors, walls, and roofs.

.8 Protecting other installed items and landscaping.

.2 Scope:

.1 This Section includes the requirements of the General Conditions as may be modified by the Supplementary Conditions regarding the protection of the Work and property, including Underground Facilities.

.2 Contractor shall provide all labour, materials, equipment, tools, services, and incidentals necessary and required for protecting the Work and property in accordance with the Contract Documents.

.3 Responsibilities for security during the Project are indicated in Section 01 57 33 - Temporary Security.

.4

.3 Related Requirements: Include, but are not necessarily limited to:

.1 Section 01 57 33 - Temporary Security.

.2 Section 01 65 50 - Product Delivery, Storage, and Handling.

.3 Section 01 74 00 - Cleaning.

1.2 PROTECTION – GENERAL

.1 Contractor shall provide all precautions and programs and perform all actions necessary to protect personnel health and safety, and to protect the Work and all public and private property and facilities from damage, in accordance with the Contract Documents, Laws and Regulations, and other applicable requirements, including **RMOW FIRE RESCUE SERVICE: INTERFACE CONSTRUCTION AND MAINTENANCE REGULATIONS.**

.2 To prevent damage, injury, and loss, Contractor's actions shall include the following:

.1 Providing measures for safety of all personnel at and adjacent to the Site, whether engaged in performing the Work, operating or maintaining the facility, or performing other functions for Owner or others.

.2 Storing construction equipment, machinery, tools, and similar items, materials and equipment to be incorporated into the Work, supplies, and other items in an orderly, safe manner that does not unduly interfere with the progress of the Work or work of others, including Owner and facility manager (if other than Owner).

.3 Suitably storing materials and equipment to be incorporated into the Work, in accordance with the Contract Documents, including Section 01 65 50 - Product Delivery, Storage, and Handling.

.4 Placing upon the Work or any part thereof only loads consistent with the safety and integrity of that portion of the Work and existing construction and facilities.

.5 Frequently removing and disposing of rubbish, scrap materials, and debris, in accordance with the Contract Documents, including Section 01 74 00 - Cleaning, resulting from Contractor's operations.

2. PRODUCTS

2.1 TEMPORARY BARRICADES

.1 Materials and Construction:

.1 Temporary barricades shall be of materials that are either new or of good quality and sufficient for the intended purpose, exposure, and duration of use.

.2 Provide temporary barricades of sturdy materials of grade, thickness, and durability sufficient for the probable loads to which they will be subject. Temporary barricades shall be in accordance with Laws and Regulations, including the applicable building and safety codes.

.3 Colour: Use appropriately coloured and reflective barricades, or paint barricades accordingly, to be visible at night and during periods of low visibility.

.4 Where owner of transportation right-of-way or transportation facility having jurisdiction or other authority having jurisdiction requires compliance with standards more stringent than the Contract Documents, comply with both the Contract Documents and requirements of the authorities having jurisdiction.

.2 Temporary Security Fencing: Comply with Section 01 57 33 - Temporary Security.

3. EXECUTION

3.1 ACCESSING OR ENTERING PROPERTY

.1 Accessing or Entering Property – General:

.1 Use and occupy only lands and easements furnished by Owner, unless appropriate consent from property owner and occupants is obtained by Contractor.

.2 The foregoing applies to personnel, construction equipment and machinery, tools, vehicles, materials or equipment to be incorporated into the Work, supplies, temporary facilities, and other items or obstructions.

.3 Limitations, if any, on accessing the Site are indicated in Section 01 55 13 - Vehicular Access and Parking.

3.2 RESPONSIBILITY TO REMEDY DAMAGED PROPERTY

.1 Contractor to Remedy Damage:

.1 Contractor has full responsibility for preserving public and private property and facilities on and adjacent to the Site.

.2 Direct or indirect damage done by, or on account of, any act, omission, neglect (including inadvertent acts), or misconduct by Contractor (including any person or entity for whom contractor is responsible) in performing the Work, shall be promptly remedied by Contractor, at Contractor's expense, in accordance with the Contract Documents.

.3 If the Contract Documents do not show or indicate the required restoration, or remedy, restore or remedy the damage to condition equal or better than that existing before damage was done.

.2 Owner May Remedy:

.1 Should Contractor fail to protect and safeguard property and the Work after requests from Engineer or Owner, Owner reserves the right to implement measures to protect property and the Work.

.2 Cost of such Owner-implemented measures shall be paid by Contractor. Owner may deduct from payments due Contractor such amounts as set-offs in accordance with the Contract Documents.

.3 Such right, however, does not obligate Owner or Engineer to continuously monitor or have responsibility for the protection of property and the Work, which responsibility is exclusively Contractor's.

.4 In exercising its rights under this provision, Owner will endeavor to give Contractor sufficient notice to allow Contractor to remedy the damage or defect within a reasonable time. However, if Owner or Engineer deems that the situation requires prompt remedy, Owner may act as quickly as Owner deems appropriate, without infringing on or mitigating Owner's rights under this provision and elsewhere in the Contract Documents

3.3 PROTECTION OF NATURAL HABITATS

.1 Tree and Plant Protection – General:

.1 Protect existing trees, shrubs, and plants on or adjacent to the Site, against unnecessary cutting, breaking, damage, and skinning of trunk, branches, bark, and roots.

.2 Protect irrigation servicing existing trees, shrubs, and plants on or adjacent to the Site that remain in place.

.3 Do not store materials or equipment, machinery, or vehicles within foliage drip lines.

.4 In areas subject to traffic, provide temporary fencing or temporary barricades to protect trees and plants.

.5 Burning is not allowed at or adjacent to the Site, including burning, in open fires or otherwise, trees, plants, debris, or other combustible materials.

.6 Comply with seasonal fire ratings and fire watches.

3.4 PROTECTION OF EXISTING SURFACE STRUCTURES

.1 Surface Structures – General:

.1 Surface structures are existing buildings, structures, and other facilities at or extending above ground surface, including their foundations and any extension below ground surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage routes, exposed piping and utilities, poles, exposed wires and cabling, posts, signs, markers, curbs, walks, fencing, and other facilities visible at or above ground surface.

.2 Protect surface structures as necessary and promptly remedy damage and defects resulting or arising from Contractor's operations. Unless expressly shown or indicated otherwise in the Contract Documents, protect such items regardless of whether shown or indicated on the Drawings or elsewhere in the Contract Documents.

.3 Protection of Overhead Utilities:

.1 Protect visible, overhead utilities, including electrical power, communications, and piped utilities, and related supports, regardless of whether such items are shown or indicated in the Contract Documents.

.2 When required by the Contract Documents or when acceptable to owner of such utility or facility, temporarily relocate overhead utilities or facilities as necessary to perform the Work.

.3 Provide temporary barriers, barricades, and warning signs identifying overhead utilities within reach of Contractor's construction equipment, machinery, or operations...

.2 Temporary Removals of Surface Structures:

.1 Existing surface facilities, including but not limited to guard rails, handrails, posts, guard cables, signs, poles, markers, curbs, and fencing, that are temporarily removed to facilitate the Work shall be replaced and restored promptly after the associated Work is performed.

.2 Replace and restore such items in accordance with the Contract Documents. If not addressed in the Contract Documents, replace and restore such items to preconstruction condition or better.

.3 Remedy damage to all items temporarily removed and later replaced and restored.

.4 All such temporary relocations, replacement, and restoration is at Contractor's cost.

.3 Protection of Surface Structures:

.1 Sustain in their original location and protect from direct and indirect injury all surface structures located within or adjacent to the Site. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure or facility.

.2 Before proceeding with the Work of sustaining and supporting such structure or facility, Contractor shall, upon Engineer's request, promptly satisfy Engineer that methods and procedures to be used have been approved by party owning the surface structure or facility.

.3 Regardless of approval or acceptance by owner of property, structure, or facility, responsibility for protecting the Work and property is solely Contractor's.

3.5 PROTECTION OF FLOORS, WALLS, AND ROOFS

.1 Protection of Floors, Walls, and Roofs – General:

.1 Use proper protective covering when moving equipment, handling materials or other loads, and when cleaning walls, ceilings, or structure contents.

.2 Maintain at the Site and use spill kits and absorbent pads for remedying spills.

.3 Do not load slabs, floors, walls, or roofs in excess of design loading.

.4 Restrict access to roofs, and keep Contractor's workers and personnel off existing roofs, except as necessary for the Work.

3.6 PROTECTION OF INSTALLED MATERIALS, EQUIPMENT, AND LANDSCAPING

.1 General:

.1 Protect existing facilities and installed Work to prevent damage from subsequent operations.

.2 Remove protective items when no longer needed, prior to Substantial Completion of the associated Work.

.3 Where work will continue in adjacent area(s) after Substantial Completion of a portion of the Work, protect the substantially completed Work until all work in the area is complete.

.2 Coverings:

.1 Provide temporary coverings to protect materials and equipment from damage.

.2 Fasten protective items without harming the Work. Use tape or adhesives that do not leave

residue when removed.

END OF SECTION

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SECTION 01 73 20
OPENINGS AND PENETRATIONS IN CONSTRUCTION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Methods of installing and sealing openings and penetrations in construction.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Section 01 73 29 – Cutting and Patching

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 .

.2 ASTM International (ASTM):

.1 C834, Standard Specification for Latex Sealants.

.2 C920, Standard Specification for Elastomeric Joint Sealants.

.3 C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

.4 E814, Standard Method of Fire Tests of Through Penetration Fire Stops.

.5 E1399, Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

.6 E1966, Standard Test Method for Fire Resistive Joint Systems.

.2 Qualifications: Sealant applicator shall have minimum five years experience using products specified on projects with similar scope.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 For each structure, provide dimensioned or scaled plan view drawings containing the following information:

.1 Vertical and horizontal location of all required openings and penetrations.

.2 Size of all openings and penetrations.

.3 Opening type.

.4 Seal type.

.3 Manufacturer's installation instructions for standard manufactured products.

2. PRODUCTS

2.1 MATERIALS

.1 Firestopping Material:

.1 Firestop sealant:

.1 Dow Corning.

.2 3M Company.

.3 Specified Technologies Inc.

.4 Hilti.

.2 Moldable putty:

.1 3M Company.

.2 Specified Technologies Inc.

.3 Hilti.

.4 Rector Seal.

.3 Expanding Foams:

.1 3 M Company.

.2 Hilti.

.2 Commercial Wall Castings:

.1 For wet/corrosive areas either side of penetration: Stainless Steel, ASTM A352 or ASTM A995.

.2 Grade equal to connecting piping system.

3. EXECUTION

3.1 INSTALLATION AND APPLICATION

.1 Obtain prior approval from Engineer when any opening larger than 645 cm^2 must be made in existing or newly completed construction.

.2 Perform electrical penetrations in accordance with the Canadian Electrical Code.

.3 Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.

.4 Do not cut into or core drill any beams, joists, or columns.

.5 Do not install sleeves in beams, joists, or columns.

.6 Do not install recesses in beams, joists, columns, or slabs.

.7 For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.

.8 Where pipes pass between classified and unclassified areas provide firestopping materials.

.1 Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

.9 Prior to placement of backer rod and sealant roughen pipe and concrete surfaces and apply activator.

.10 Do not make duct or conduit penetrations below high-water levels when entering or leaving tankage, wet wells, or other water holding structures.

.11 Modular Mechanical Seals:

.1 Install seals such that bolt heads are located on the most accessible side of the penetration.

.12 Backer Rod and Sealant:

.1 Provide backer rod and sealant for modular mechanical seal applications.

.1 Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.2 SCHEDULES

.1 Provide the following opening and penetration types:

.1 Type A - Block out 50mm larger than outside dimensions of duct, pipe, or conduits.

.2 Type B - Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.

.3 Type C - Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.

.4 Type D - Commercial type casting or fabrication.

.5 Type E - Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.

.6 Type F - Integrally cast pipe with thrust ring, duct or conduit.

.7 Type G - Saw cut or line-drill and remove area 1 inch larger than outside dimensions of duct, pipe or conduit.

.8 Type H - Core drill.

.9 Type I - Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.

.10 Type J - Grating Banding for any field cut openings.

.2 Provide seals of material and method described as follows.

.1 Category 1 - Modular Mechanical Seal.

.2 Category 2 - Roof curb and flashing according to RCABC specifications unless otherwise noted on Drawings. Refer to Specification Section 07 62 00 and roofing Specification Sections for additional requirements.

.3 Category 3 - 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.

.4 Category 4 - Backer rod and sealant.

.5 Category 5 - Full depth compressible sealant with escutcheons on both sides of opening.

.6 Category 6 - Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 12mm larger than opening.

.7 Category 7 - Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.

.8 Category 8 - Banding for all grating openings and banding and cover plate of similar materials for abandoned openings.

.3 Furnish openings and sealing materials through new floors, roofs, grating, partitions and walls in accordance with Schedule A, Openings and Penetrations for New Construction.

.4 Furnish openings and sealing materials through existing floors, grating, roofs, partitions and walls in accordance with Schedule B, Openings and Penetrations for Existing Construction.

SCHEDULE A. OPENINGS AND PENETRATIONS SCHEDULE FOR NEW CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	C F I	7 Not Req 7	D F I (1)	Not Req Not Req 7	C F	7 Not Req
Through floors on grade above water table	C F I	4 Not Req 4	C F I (1)	7 Not Req 7	C F I (1)	4 Not Req 7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C I	4 4	C H (2) I (1)	4 3 4	F H (2) I (1)	Not Req 3 7
Through walls where one side is a hazardous area	C F I	7 Not Req 7	D F I (1)	Not Req Not Req 7	C F	7 Not Req
Through exterior wall below grade above water table	C F I	7 Not Req 7	C D F I (1)	1 Not Req Not Req 1	F I (1)	Not Req 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	C F I	7 Not Req 7	C D F H (2)	1 Not Req Not Req 1	C F H (2) I (1)	7 Not Req 7 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req
Through exterior wall above grade	A C	6 6	A D H (2)	5 Not Req 5	C H (2)	5 4
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A C	4 4	A C	4 4	A C F	4 4 Not Req
Grating openings and penetrations	J	8	J	8	J	8

SCHEDULE B. OPENINGS AND PENETRATIONS SCHEDULE FOR EXISTING CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors with bottom side a hazardous location	B E	7 Not Req	B (1) E (3) H (2)	7 Not Req 7	B (1) E (3) H (2)	7 Not Req 7
Through floors on grade above water table	B	7	B	7	B	7
Through slab on grade below water table	E	Not Req	E	Not Req	E	Not Req
Through floors in washdown areas	G	3	G H (2)	3 3	G H (2)	3 3
Through walls where one side is a hazardous area	B E	7 Not Req	B (1) B (3) E H (2)	7 1 Not Req 7	B (1) (3) E H (2)	7 Not Req 7
Through exterior wall below grade above water table	B	7	B (1) B (3) H (2)	7 1 7	B (1) (3) H (2)	7 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	B E	7 Not Req	B E H (2)	1 Not Req 1	B (1) (3) E H (2)	7 Not Req 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	E	Not Req	E	Not Req	E	Not Req
Through exterior wall above grade	G	6	G (1) (3) H (2)	5 5	G (1) (3) H (2)	5 7
Roof penetrations	G	2	G (1) (3) H (2)	2	G	2
Through interior walls and slabs not covered by the above applications	G	4	G (1) (3) H (2)	4 4	G (1) (3) H (2)	4 4
Grating openings and penetrations	J	8	J	8	J	8

(1) Multiple piping 75mm and smaller or multiple conduits.
(2) Single pipe 75mm and smaller or single conduit.
(3) Single pipe or conduit larger than 75mm.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for cutting and patching Work.

.2 Scope:

.1 Contractor shall perform cutting and coring, and rough and finish patching of holes and openings in existing construction.

.2 Cutting and coring in new construction is not permitted unless agreed to by the Engineer.

.3 Provide cutting, coring, fitting, and patching, including attendant excavation and fill, required to complete the Work, and to:

.1 remove and replace defective Work;

.2 remove samples of installed Work as specified or required for testing;

.3 remove construction required to perform required alterations or additions to existing construction;

.4 uncover the Work for Engineer's observation of covered Work, testing, or inspection by testing entities, or observation by authorities having jurisdiction;

.5 connect to completed Work not performed in proper sequence;

.6 remove or relocate existing utilities and piping that obstruct the Work in locations where connections are to be made;

.7 make connections or alterations to existing or new facilities.

1.2 SUBMITTALS

.1 Action Submittals: Submit the following:

.1 Cutting and Patching Request:

.1 Submit written request to Engineer, well in advance of executing cutting or alteration that affects one or more of the following:

.1 Design function or intent of the Project.

.2 Work of Owner or other contractors retained by Owner.

.3 Structural capacity or integrity of an element of the Project, building, or structure.

.4 Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.

.5 Efficiency, operational life, maintenance, or safety of operational elements.

.6 Visual qualities of elements that will be exposed to view after completion of the Work.

.2 Request shall include:

.1 Identification of Project and Contract designation.

.2 Description of affected Work of Contractor and work of others (if any) retained by Owner.

.3 Necessity for cutting.

.4 Effect on work or operations of Owner and other contractors (if any) retained by Owner, and on structural and weatherproof integrity of Project, building, or structure.

.5 Description of proposed Work, indicating: scope of cutting and patching; trades that will execute the cutting and patching Work; materials and equipment to be used; extent of refinishing; schedule of operations; alternatives (if any) to cutting and patching, and net effect on aesthetics following completion of finishing Work.

.6 Indication of entity responsible for cost of cutting and patching, when applicable.

.7 Written permission of other prime contractors (if any) whose work will or may be affected.

.2 Recommendation Regarding Cutting and Patching:

.1 Should conditions of work or schedule indicate a change of materials or specified methods, furnish Submit written recommendation to Engineer including:

.1 Conditions indicating change.

.2 Recommendations for alternative materials or alternatives to specified methods.

.3 Material manufacturer's printed recommendations for the proposed product and recommendations of manufacturer's technical representative for the specific application(s). The latter shall be on the technical representative's letterhead and shall explicitly indicate the Project and specific cutting and patching application(s) to which the recommendation(s) apply.

.4 Items required with a request for approval of substitute, in accordance with the substitution request requirements of the Contract Documents.

.3 Product Data:

.1 Submit the manufacturer's published data for the protective compound to be applied to core-drilled surfaces and cut concrete surfaces.

.2 When not required under other Specifications sections, submit the manufacturer's published data on materials to be used for finishing around the cut or patched area(s), together with an indication of the location(s) where each is proposed for use.

.3 Furnish Submittals for patching materials under the associated Specifications section. Submittal to include letter of recommendation from product manufacturer's technical representative indicating on technical representative's letterhead, explicitly indicating:

.1 Project name and facility name;

.2 specific cutting and patching application(s) to which the recommendations apply;

.3 that the product manufacturer's technical representative has personally observed and is familiar with conditions in the work area(s) of the subject cutting and patching;

.4 materials that are the subject of the Submittal are appropriate for the condition(s) of the proposed patch and will remain durable in the patch's final exposure upon Substantial Completion; and.

.5 patching material manufacturer's technical representative's recommendations for surface preparation, installation of patching material(s), and curing.

.2 Informational Submittals: Submit the following:

.1 Written Notification of Cutting and Patching:

.1 Furnish as a Submittal written indication designating the day and time that the construction associated with cutting and patching will be uncovered to allow for observation. Do not begin cutting or patching operations until submittal is accepted by Engineer.

2. PRODUCTS

2.1 MATERIALS

.1 Materials – General:

.1 Provide materials that comply with the Contract Documents.

.2 If not shown or indicated in the Contract Documents, use materials identical to existing materials affected by cutting and patching Work.

.3 For exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. If identical materials are unavailable or cannot be used, provide materials, whose installed performance will equal or surpass that of existing materials.

.4 Replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, using materials that do not void required or existing warranties.

.2 Compound Applied to Core-Drilled Surfaces and Cut Concrete Surfaces:

.1 After core-drilling or sawcutting (as applicable) and before installing the utility or equipment through the penetration, coat exposed concrete and exposed steel with solvent-free, two-component, protective, epoxy resin coating.

.2 Colour shall approximate the finish colour of the existing surface to be coated.

.3 Product and Manufacturer: Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:

.1 Sikagard 62, by Sika Corporation.

.2 Or equal.

3. EXECUTION

3.1 EXAMINATION

.1 Examination and Assessment – General:

.1 Examine surfaces to be cut or patched and conditions under which cutting or patching will be performed before starting cutting or patching Work.

.2 Report unsatisfactory or questionable conditions to Engineer in writing.

.3 Do not proceed with cutting or patching Work until unsatisfactory conditions are corrected.

.2 Non-Destructive Investigation:

.1 In advance of cutting or coring through existing slabs or walls, use x-ray or other non-destructive methods accepted by Engineer to determine location of reinforcing steel, electrical conduits, and other items embedded in slabs and walls.

.2 Submit to Engineer written report of findings of evaluation.

.3 Perform investigation and submit results to Engineer sufficiently in advance of cutting Work to allow time to identify and implement alternatives if changes to the Work are necessary because of conduit or other features in floor or wall.

3.2 PREPARATION

.1 Provide temporary support required to maintain the structural integrity of facilities, to protect adjacent work from damage during cutting, and to support the element(s) to be cut.

.2 Protection of Existing Construction during Cutting and Patching:

.1 Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project and facility that will be exposed during cutting and patching operations.

.2 Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

.3 Do not cut existing pipes, conduit, ductwork, or other utilities serving facilities scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 CUTTING AND PATCHING – GENERAL

.1 Perform cutting and coring in such manner that limits extent of patching required;

.2 Structural Elements:

.1 Do not cut or patch structural elements in manner that would change the element's structural load-carrying capacity as load deflection ratio.

.3 Operating Elements:

.1 Do not cut or patch operating elements in manner that would reduce their capacity to perform as intended.

.2 Do not cut or patch operating elements or related components in manner that would increase maintenance requirements or decrease operational life or safety.

.4 Replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, using methods that do not void required or existing warranties.

.5 Provide adequate temporary covering over openings (whether cut or core-drilled) where not in use. Avoid creating tripping hazards for openings provided in floors and slabs.

3.4 CORING

.1 Use core-drilling to make penetrations through concrete and masonry walls, slabs, or arches, unless otherwise accepted by Engineer in writing.

.2 Coring:

.1 Perform coring with non-impact rotary tool using diamond core-drills. Size holes for pipe, conduit, sleeves, equipment or mechanical seals, as required, to be installed through the penetration.

.2 Do not core-drill through electrical conduit or other utilities embedded in walls or slabs without the approval of the Engineer. To the extent possible, avoid cutting reinforcing steel in slabs and walls.

.3 Protection:

.1 Protect existing equipment, utilities, and adjacent areas from water and other damage caused by or resulting from core-drilling operations.

.2 After core-drilling and before installing the utility or equipment through the penetration, coat exposed concrete and steel with protective coating material indicated in Paragraph 2.1.B of this Specification Section. Apply protective coating in accordance with the manufacturer's instructions.

.4 Cleaning:

.1 After core drilling, vacuum or otherwise remove slurry and tailings from the work area.

3.5 CUTTING

.1 Cutting – General:

.1 Cut existing construction using methods least likely to damage elements retained and adjoining construction and that provide proper surfaces to receive subsequent installation or repair.

.2 In general, use hand tools or small power tools suitable for sawing or grinding. When possible, avoid using hammering and avoid chopping. Carefully chip out concrete where necessary and as indicated in the Contract Documents.

.3 Cut holes and slots as small as possible, neatly to the size required, and with minimum disturbance of adjacent surfaces.

.4 Prior to starting cutting, provide adequate bracing of area to be cut.

.5 To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into the concealed side.

.6 Use equipment of adequate size to remove the cut panel or "coupon".

3.6 PATCHING

.1 Patching – General:

.1 Patch construction by filling, repairing, refinishing, closing-up, and similar operations following performance of other Work.

.2 Patch with durable seams that are as inconspicuous as possible. Provide materials and comply with installation requirements indicated in the Contract Documents and the published installation instructions of the material's manufacturer.

.3 Patch to provide airtight and watertight connections to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.4 Where feasible, test patched areas to demonstrate integrity of installation.

.2 Restoration:

.1 Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that eliminates evidence of patching and refinishing.

.2 For continuous surfaces, refinish to nearest intersection.

.3 For an assembly, refinish the entire unit that was patched.

.4 Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 CLEANING

.1 Cleaning and Restoration:

.1 Perform cleaning promptly after associated cutting, coring, and patching.

.2 Clean areas and spaces where cutting, coring, or patching were performed.

.3 Clean piping, conduit, and similar constructions before applying paint or other finishing materials.

.4 Restore damaged coverings of pipe and other utilities to original condition.

END OF SECTION

SECTION 01 74 00
CLEANING

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Requirements for keeping the Site free of accumulations of waste materials during construction ("progress cleaning").

.2 Cleaning for Substantial Completion and prior to final inspection (collectively, "closeout cleaning").

.2 Scope:

.1 Contractor shall perform cleaning during the Project, including progress cleaning, as a condition precedent to Substantial Completion, upon completion of the Work, and as required by the General Conditions, as may be modified by the Supplementary Conditions, this Specifications section, and elsewhere in the Contract Documents.

.2 Maintain in a clean manner the Site, the Work, and areas adjacent to or affected by the Work.

2. PRODUCTS - (NOT USED)

3. EXECUTION

3.1 PROGRESS CLEANING

.1 Progress Cleaning – General:

.1 Clean the Site, work areas, and other areas occupied by Contractor not less than weekly. Dispose of waste materials in accordance with the General Conditions, as may be modified by the Supplementary Conditions, and the following:

.1 Provide suitable containers for storage of waste materials and debris. Avoid the generation of odours and the creation of nuisances and provide wildlife proof enclosures.

.2 Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately.

.2 Progress Cleaning – Site:

.1 Keep outdoor, dust-generating areas wetted down or otherwise control dust emissions.

.3 Progress Cleaning – Work Areas:

.1 Clean areas where the Work is in progress to maintain an extent of cleanliness necessary for the proper execution of the Work and safety of personnel.

.2 Remove liquid spills promptly. Where spills may have harmful effects on health, safety, protection of facilities, or the environment, immediately report spills to Owner, Engineer, and authorities having jurisdiction, in accordance with the Contract Documents and Laws and Regulations.

.3 Where dust would impair proper execution of or quality of the Work, broom-clean or vacuum entire work area, as necessary.

.4 Concealed Spaces: Remove waste material and debris from concealed spaces before enclosing the space.

.4 Progress Cleaning – Cutting and Patching:

.1 Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, trailings and cuttings, and similar materials.

.2 Comply with Section 01 73 29 - Cutting and Patching, regarding cleaning during and after cutting and patching Work.

.3 Thoroughly clean piping, ductwork, conduits, and similar features before applying patching material, paint, or other finishing materials.

.4 Restore damaged insulation and coverings on piping, cutwork, and similar items to its pre-construction condition.

.5 Waste Disposal:

.1 Properly dispose of waste materials (including surplus materials, debris, rubbish, and other waste) off the Site.

.2 Do not burn or bury waste materials at the Site.

.3 Remove waste material and rubbish from excavations before backfilling.

.4 Do not discharge volatile or hazardous substances, such as mineral spirits, oil, or paint thinner, into storm sewers, gutters, sanitary sewers, sumps or other locations in the environment. Dispose of such materials in accordance with Laws and Regulations.

.5 Do not discharge wastes to surface waters, drainage routes, or groundwater.

.6 Contractor is solely responsible for complying with Laws and Regulations regarding storing, transporting, and disposing of waste generated by Contractor's operations or brought to the Site by Contractor.

.7 Comply with RMOW Solid Waste By-Law.

.6 During handling and installation of materials and equipment, clean and protect construction in progress and adjoining materials and equipment already in place. Apply protective covering where necessary or required for protection from damage or deterioration, until Substantial Completion.

.7 Clean completed construction as frequently as necessary throughout the construction period.

3.2 CLOSEOUT CLEANING

.1 Complete the following prior to requesting inspection for Substantial Completion:

.1 Clean and remove from the Site waste material (including rubbish and debris) and other foreign and undesirable items and substances.

.2 Remove spills and stains of petroleum, oils, solvents, other chemicals, and other foreign and undesirable deposits.

.3 Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of spatter, grease, stains, fingerprints, films, and similar foreign and undesirable substances.

.4 Remove non-permanent tags and labels.

.5 Surface Finishes:

.1 Touch-up and otherwise repair and restore chipped, scratched, dented or otherwise marred surfaces to specified finish and match adjacent surfaces.

.2 Do not paint over "ULC" or similar labels, including mechanical and electrical nameplates.

.6 Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign or undesirable substances.

.7 Leave the Site clean, and in neat, orderly condition, satisfactory to Owner and Engineer.

.2 Complete the following prior to requesting final inspection:

.1 After Substantial Completion of all the Work, following completion of items of incomplete or damaged Work ("punch list Work"), clean "punch list Work areas in accordance with this Specifications Section.

.2 Remove field offices, Contractor's storage sheds, and remaining stockpiles and clean all such areas in accordance with this Specifications Section, and in accordance with Contract Documents for landscaping and restoration.

END OF SECTION

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SECTION 01 75 00
CHECKOUT AND START-UP PROCEDURES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Administrative and procedural requirements for checkout and startup of equipment, systems, and facilities.

.2 Scope:

.1 Contractor shall initially check out, start-up, and place supplied equipment and systems installed under the Contract into successful operation, in accordance with the material and equipment manufacturers' written instructions, Suppliers' recommendations at the Site, and the Contract Documents.

.2 Provide the following:

.1 All labour, tools, materials, and equipment required to complete equipment and system checkout and startup.

.2 Temporary or consumable items necessary for checkout, startup, and initial operation of the Work.

.3 Start-up documentation required by the Supplier to initiate start-up activities.

.3 The General Conditions, as may be modified by the Supplementary Conditions, address requirements for documenting Substantial Completion.

.3 Owner Responsibilities:

.1 Owner is responsible for start-up of Owner supplied equipment or existing equipment under the direct control of the Owner.

.4 Related Sections include but are not necessarily limited to:

.1 Section 01 61 03 - Equipment - Basic Requirements.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate checkout and startup with other contractors and the equipment Supplier, as necessary.

.2 Do not start up equipment or system(s) for continuous operation until all components of that equipment item or system, including instrumentation and controls, have been tested to the extent practicable and proven to be operable as intended by the Contract Documents.

.3 Subject to the constraints of this Specifications section, the Owner will furnish sufficient personnel to assist Contractor in starting up equipment and system(s), but responsibility for proper operation of the Work is Contractor's.

.4 Supplier shall be present during checkout, startup, and initial operation unless otherwise acceptable to Engineer or otherwise required by the Contract Documents. The Owner has incorporated reasonable time for the Supplier to be on-site to undertake and oversee the commissioning and start-up of the Owner-supplied equipment.

.2 Checkout and Startup Planning Meeting:

.1 Contractor, with appropriate Subcontractors and Suppliers, shall attend and participate in a meeting with Owner, facility manager, and Engineer to discuss planning, scheduling, and coordination of checkout and startup activities.

.2 Meeting shall be held by the earlier of: (1) not less than 30 days prior to the first scheduled training session provided by the Supplier for the equipment and system(s) to be checked out and started-up, and (2) not less than 10 days prior to the checkout and startup of the associated equipment and system(s).

.3 Attend meeting prepared to knowledgeably and effectively discuss:

.1 Status of the Work and schedule-to-complete for requirements prerequisite to checkout and startup.

.2 Schedule for and status of Supplier provided training required for each equipment item and system.

.3 Schedule for checkout, startup, and field quality control activities for the subject Work.

.4 Status and quantities of required consumables and utility services necessary for checkout and startup.

.4 Meeting will be chaired by Engineer. Engineer will prepare and distribute a record of topics discussed and decisions made during the meeting.

.5 Comply with decisions made at the meeting and the Contract Documents.

.3 Sequencing:

.1 Comply with Section 01 14 16 - Coordination with Owner's Operations, regarding staging (phasing) of the Work and allowable shutdowns.

.4 Scheduling:

.1 Progress Schedule:

.1 Clearly indicate in the Progress Schedule planned and actual dates for checkout, startup, and field quality control activities, including all demonstration testing activities addressed in this Specifications section and elsewhere in the Contract Documents. Separately indicate checkout, startup, and field quality control activities for each equipment item and system.

.2 Perform startup and field quality control activities on the associated, scheduled dates, unless otherwise acceptable to Owner, facility manager, and Engineer.

.2 Restrictions for Scheduling:

.1 Checkout of materials, equipment, and systems by Contractor that do not involve or require Owner's or facility manager's personnel may be performed at any time during normal working hours. Where required by the Contract Documents or requested by Engineer, perform checkout in the presence of Engineer.

.2 Startup, including initial operation of materials, equipment, and systems, shall not be initiated on: Monday, Friday, Saturday, Sunday, Statutory holidays, the day immediately prior to a holiday, or the day immediately following a holiday, unless otherwise acceptable to Owner, facility manager, and Engineer.

.3 Unless otherwise indicated in the Contract Documents or acceptable to Owner, facility manager, and Engineer, perform all startup during normal working hours of the day shift.

.4 To the extent practicable, where extended-duration startup or field quality control activities are required by the Contract, avoid having such activities extend into evening, night, weekend, or holiday hours.

.5 Owner reserves the right to require a minimum of seven days' notice of rescheduled startup when the Contractor cannot perform the associated activities as scheduled.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Do not start up equipment or systems or place them into initial operation until required operating permits are obtained from authorities having jurisdiction.

1.4 DEFINITIONS

.1 The following defined terms are used in this Specifications Section:

.1 Instrumentation Supplier: Entity retained by Contractor, Subcontractor, or Supplier to furnish instrumentation or controls that will be part of the completed Work, including manufacturers, manufacturer representatives, wholesalers, retailers, and others, including entities retained to perform systems integration Work.

.2 Project Classified System (PCS): An established, distinct part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, cabling, materials, and incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.

.3 Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which the Contractor, with assistance from Suppliers representatives, performs in the following sequence:

.1 Finishing type construction work to ensure the Project has reached a state of Substantial Completion.

.2 Equipment start-up.

.3 Personnel training.

.4 Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the Project Classified System and starts up and operates the Project Classified System, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the Project Classified System as evidence of Substantial Completion.

.1 Demonstration period shall be initiated and supported by the Contractor and managed and led by the Supplier.

1.5 SUBMITTALS

.1 Action Submittals: Submit the following:

.1 Data collection and reporting log for each required Demonstration Period.

.2 Informational Submittals: Submit the following:

.1 Progress Schedules indicating dates for checkout, startup, and field quality control activates.

.3 Certificates:

.1 Certificate of Installation Form 102

.2 Certificate of Satisfactory System Performance Form 103

2. PRODUCTS - (NOT USED)

3. EXECUTION

3.1 CHECKOUT AND STARTUP – GENERAL

.1 Facility Startup Divided into Two Periods:

.1 Pre-Demonstration Period including:

.1 Obtain Engineer's approval or acceptance (as applicable) of Submittals required prior to checkout and startup, including all Shop Drawings, Samples, source quality control (shop testing) Submittals, preliminary operation and maintenance manuals, and other Submittals required by the Contract Documents, other than Submittals that cannot be furnished until after startup.

.2 Complete the Work to a point ready for checkout and startup, including operation available in all manual, automatic, and other modes.

.3 Checkout and initial field quality control activities that can be performed prior to the startup of the equipment or system.

.4 Startup of the associated Work.

.5 Field quality control activities for the subject Work as indicated elsewhere in the Specifications and other Contract Documents, other than this section.

.6 Training of operations and maintenance personnel.

.2 Demonstration Period, including:

.1 Demonstration of functional integrity of equipment, system, or PCS.

3.2 PRE-DEMONSTRATION PERIOD

.1 Prior to the Pre-Demonstration Period, complete the Work to the point where it is ready for checkout and startup.

.1 Complete Form 102

.2 Startup:

.1 Schedule, coordinate, and assist with Owner during the start-up of Equipment. The contractor to be responsible for equipment supplied as part of this Contract Document.

.2 Prepare the Work so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.

.3 Perform startup to the extent possible without introducing process flow.

.4 Procedures include but are not necessarily limited to the following with primary responsibility as noted or shared.

.3 Demonstration Period – General:

.1 Coordinate with the Supplier to demonstrate the operation and performance of mechanical, electrical, instrumentation, and control interfaces of the Work undergoing the Demonstration Period in accordance with the Contract Documents.

.2 Duration of Demonstration Period: 5 consecutive days (two Monday to Friday periods).

.3 If, during the Demonstration Period, the aggregate time used for repair, alteration, or unscheduled adjustments to any part of the Work that renders the affected Work inoperative or operation outside of recommended ranges exceeds 25 PCT of the Demonstration Period, the demonstration of operation and performance will be deemed unacceptable and Contractor (for connections to and from the equipment) or Supplier (Equipment or connections within the equipment) shall provide appropriate adjustments and remedies and re-perform the Demonstration Test, at no additional cost to Owner or facility manager, until acceptable results are obtained. Re-performance of the Demonstration Period shall comply with the same requirements as the original Demonstration Period.

.4 Perform the demonstration of operation and performance of the Work under full operational conditions.

.5 Owner’s or Facility Manager’s Personnel:

.1 Owner or facility manager (as applicable) will make available operations personnel to make process decisions affecting facility performance and compliance with applicable operating permits.

.2 Owner's or facility manager’s assistance will be available only for process decisions.

.3 Contractor or Supplier will perform all other functions associated with the Demonstration Period, including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period in accordance with the Contract Documents.

.6 Owner or facility manager reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, and similar actions and events during the Demonstration Period to verify the operation and performance, manual, and other types of operating modes, and backup systems.

.7 Timing of Start and End of Demonstration Period:

.1 The Supplier and the Contractor shall propose a time to start and end the demonstration period which aligns with standard Operations staff shifts.

.4 Demonstration Period, Evaluation, and Acceptance:

.1 Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions and to respond to problems or failures of the Work.

.2 Responsibilities for Sampling and Data Collection:

.1 Support the Supplier with collection of performance data.

.3 Data Evaluation:

.1 Engineer, in consultation with the Owner as necessary, will evaluate the data collected during the Demonstration Period and other information obtained during the Demonstration Period for compliance with the Contract Documents.

.2 Engineer will advise the Contractor in writing of whether the data and information obtained indicate that the Demonstration Period was successfully completed.

.4 Criteria for Acceptance will be provided along with a copy of the Contract documents with the Supplier.

.5 Contractor to provide support services during start-up in accordance with the following roles and responsibilities table.

.6 Complete Form 103

END OF SECTION

CERTIFICATE OF SATISFACTORY INSTALLATION FORM 102

I have completed my check and inspection of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

Project _____

Item of Equipment _____

Tag No. _____

Reference Specification _____

Outstanding Defects _____

_____ _____
(Authorized Signing Representative of the Supplier) Date

_____ _____
(Authorized Signing Representative of the Installation Contractor) Date

CERTIFICATE OF SATISFACTORY SYSTEM PERFORMANCE FORM 103

We certify that the system listed below has been continuously operated for at least ten (10) consecutive days and that the system operates satisfactorily and meets its specified operating criteria. No defects in the system were found. The system is therefore classed as "conforming".

Project _____

Item of Equipment _____

Tag No. _____

Reference Specification _____

_____ _____
(Authorized Signing Representative of the Supplier) Date

_____ _____
(Authorized Signing Representative of the Installation Contractor) Date

_____ _____
(Authorized Signing Representative of the Consultant) Date

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SECTION 01 77 19
CLOSEOUT REQUIREMENTS

1. GENERAL

1.1 SUMMARY

.1 Section Includes: Administrative and procedural requirements for:

.1 Substantial Completion.

.2 Final inspection.

.3 Request for final payment and acceptance of the Work.

1.2 SUBSTANTIAL COMPLETION

.1 Substantial Completion – General:

.1 Prior to requesting inspection for Substantial Completion, perform the following for the substantially completed Work:

.1 Materials and equipment for which Substantial Completion is requested shall be fully ready for their intended use, including full operating and monitoring capability set forth in the Contract Documents.

.2 Complete field quality control Work, including inspections and testing at the Site, indicated in Specifications sections for individual materials and equipment items and related Contract Documents.

.3 Complete checkout and startup in accordance with Section 01 75 00 - Checkout and Startup Procedures, requirements of the Specifications for the various materials and equipment in the substantially completed Work, and related Contract Documents.

.4 Cleaning for Substantial Completion shall be completed in accordance with Section 01 74 00 - Cleaning.

.5 Obtain and submit to Engineer all required permits, inspections, and approvals of authorities having jurisdiction for the substantially completed Work to be occupied and used by the Owner.

.6 Complete other tasks that the Contract requires to be completed prior to Substantial Completion.

.2 Procedures for requesting and documenting Substantial Completion are in the General Conditions, as may be modified by the Supplementary Conditions.

1.3 FINAL INSPECTION

.1 Final Inspection – General:

.1 Prior to requesting the final inspection, verify that all the Work is fully complete and ready for final payment. A partial checklist for this purpose is attached to this Specifications section.

1.4 REQUEST FOR FINAL PAYMENT AND ACCEPTANCE OF THE WORK

.1 Procedure:

.1 After successful completion of the final inspection, submit a request for final payment in accordance with the Agreement and General Conditions, as may be modified by the Supplementary Conditions and this Specifications section.

.2 Acceptance of the Work:

.1 Upon the Engineer's concurrence that the Work is complete and ready for final payment (as a result of the final inspection and other communications between the parties and Engineer) and receipt of the final Application for Payment, accompanied by other required Contract closeout documentation, all in accordance with the Contract Documents, Engineer will issue to Owner and Contractor a notice of acceptability of the Work, in accordance with the General Conditions, as may be modified by the Supplementary Conditions.

.2 Nothing other than receipt of such notice of acceptability from the Engineer constitutes acceptance of the Work.

.3 Receipt of Engineer's notice of acceptability of the Work does not relieve Contractor of Contractor's continuing obligations under the Contract, including correction period obligations, warranty obligations, indemnification obligations, insurance requirements, and Contractor's other obligations following acceptance of the Work by Engineer and final payment. Such obligations shall commence and remain in effect as indicated elsewhere in the Contract Documents.

2. PRODUCTS - (NOT USED)

3. EXECUTION – (NOT USED)

END OF SECTION

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SECTION 01 78 36
WARRANTIES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for warranties required in the various Specifications.

.2 Provisions addressing:

.1 Suppliers' standard warranties.

.2 Suppliers' special or extended warranties.

.3 Commencement and duration of warranties.

1.2 SUBMITTALS

.1 General:

.1 For each item of equipment furnished under the Contract, submit Supplier's standard warranty, regardless of whether such warranty or Submittal thereof is required by the associated Specifications for that item. Submit such warranties for materials where such Submittal is required in the Specifications for the material.

.2 Supplier's warranties shall be specifically endorsed to Owner, Contractor, and the entity purchasing the item (if other than Contractor) by the entity issuing such warranty.

1.3 CONTRACTOR'S GENERAL WARRANTY AND CORRECTION PERIOD OBLIGATIONS

.1 Contractor's General Warranty and Guarantee: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

.2 Correction Period: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

1.4 SUPPLIERS' WARRANTIES FOR MATERIALS AND EQUIPMENT

.1 Warranty Types:

.1 Required by the General Conditions:

.1 Warranties specified for materials and equipment shall be in addition to, and run concurrently with, the Contractor's general warranty and guarantee and requirements for the Contract's correction period.

.2 Disclaimers and limitations in specific materials and equipment warranties do not limit the Contractor's general warranty and guarantee, nor does such affect or limit the Contractor's performance obligations under the correction period.

.2 Unless otherwise specified in the specifications, standard manufacture warranties shall apply.

1.5 COMMENCEMENT AND DURATION OF WARRANTIES

.1 Commencement of Warranties:

.1 Contract correction period and Contractor's general warranty commence as indicated in the General Conditions, as may be modified by the Supplementary Conditions.

.2 Duration of Warranties:

.1 Duration of the correction period is set forth in the General Conditions (Section 30), as may be modified by the Supplementary Conditions.

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Requirements for Project record documents to supplement record documents requirements of the General Conditions, as may be modified by the Supplementary Conditions.

.2 Requirements for Operational and Maintenance Manuals associated with Contractor Supplied Equipment.

.2 Scope:

.1 Contractor shall provide all labour, materials, equipment, and services to establish, maintain, continuously update, and submit to Engineer Project record documents in accordance with the Contract Documents.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Obtain necessary field measurements and record all data required for Project record documents before covering up the Work or building on subsequent phases of the Work.

.2 Promptly after obtaining measurements and information, record the data and information on Project record documents.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Recorder of Changes and Field Conditions on Project Record Documents:

.1 Contractor’s staff at the Site shall include not less than one person with suitable training and drafting (drawing) experience to record on the Project record documents changes made and field conditions encountered.

.2 Recorder of changes and field conditions on the Project record documents shall possess not less than two semesters of drafting (drawing) training in a classroom, either in high school, college, or bona-fide vocational school.

.3 Upon Engineer’s request, submit name of proposed recorder at the Site, resume', or list of relevant experience, and copy of credentials of completion of such drafting (drawing) course(s).

1.4 SUBMITTALS

.1 Closeout Submittals: Submit the following:

.1 Record Documentation:

.1 Prior to readiness for final payment, submit to Engineer one copy of Project's final record documents and obtain Engineer's acceptance of same. Submit complete record documents; do not make partial Submittals without Engineer's concurrence.

.2 Submit the following Project record documents:

.1 Record Drawings, including those issued via Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.

.2 Record project manual, including Specifications, indicating changes made via Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.

.3 Submit record documents with transmittal letter on Contractor's letterhead in accordance with requirements in Section 01 33 00 - Submittal Procedures.

1.5 MAINTENANCE OF RECORD DOCUMENTS

.1 Maintain in the Contractor's office, in a clean, dry, legible condition, complete sets of the following record documents:

.1 Drawings, Specifications, and Addenda;

.2 Shop Drawings, Samples, and other Submittals, including records of test results, approved or accepted as applicable by the Engineer;

.3 Change Orders, Work Change Directives, Field Orders, allowance authorizations;

.4 Copies of all interpretations and clarifications issued;

.5 Photographic documentation; and

.6 all other documents pertinent to the Work.

.2 Do not use Project record documents for any purpose other than serving as Project records. Do not remove Project record documents from the Contractor's field office without Engineer's approval.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Recording Changes, Field Conditions, and Other Information – General:

.1 Keep record documents current and consistent with the progress of the Work. Make entries on record documents within two working days of receipt of the information required to record the change, field condition, or other pertinent information.

.2 Do not permanently conceal the Work until the required information has been recorded for Project record documents.

.3 Accuracy of record documents shall be such that future searches for items shown on the record documents may rely reasonably on information obtained from Engineer-accepted Project record documents.

.4 Marking of Entries:

.1 Use erasable, coloured pencils (not ink or indelible pencil) for marking changes, revisions, additions, and deletions to Project record documents.

.2 Clearly describe the change by graphic line and make notations as required. Use straight edge to mark straight lines. Writing shall be legible and sufficiently dark to allow scanning of record documents into legible electronic files in "portable document format" (.PDF) files.

.3 Date each entry on record documents.

.4 Indicate changes by drawing a "cloud" around the change(s) indicated.

.5 Mark initial revisions in red. In the event of overlapping changes, use different colours for subsequent changes.

.2 Drawings:

.1 Record changes on copy of the Drawings. Submittal of Contractor-originated or -produced drawings as a substitute for recording changes on a copy of the Drawings is unacceptable.

.2 Record changes on plans, sections, elevations, schematics, schedules, and details as required for clarity, accuracy, and completeness, making reference dimensions and elevations (to Project datum) for complete record documentation.

.3 Record actual construction including:

.1 Depths of various elements of foundation relative to Project datum.

.2 Horizontal and vertical location of Underground Facilities referenced to permanent surface improvements and Project elevation datum. For each Underground Facility, including pipe fittings, show and indicate dimensions to not less than two permanent, visible surface improvements.

.3 Location of exposed utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure and, where applicable, to Project elevation datum.

.4 Changes in structural and architectural elements of the Work, including changes in reinforcing.

.5 Field changes of dimensions, arrangements, and details.

.6 Changes made in accordance with Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.

.7 Changes in details on the Drawings. Submit additional details prepared by Contractor when required to document such changes.

.4 Recording Changes for Schematic Layouts:

.1 In some cases, on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items are shown schematically and are not intended to portray physical layout. For such cases, the final physical arrangement shall be determined by Contractor subject to acceptance by Engineer.

.2 Record on the Project record documents all revisions to schematics on the Drawings, including piping schematics, ducting schematics, process and instrumentation diagrams, control and circuitry diagrams, electrical one-line diagrams, electrical panel and other schematics when included in the Drawings. Show and indicate actual locations of equipment, lighting fixtures, in-place grounding system, and other pertinent data.

.3 When dimensioned plans and dimensioned sections or elevations on the Drawings show the Work schematically, indicate on the Project record documents by dimensions accurate to within one centimetre in the field, centerline location of items of Work such as conduit, piping, ducts, and similar items

.1 Clearly identify each item of the Work by accurate notations such as “cast iron drain”, “rigid electrical conduit”, “copper waterline”, and similar descriptions.

.2 Show by symbol or by note the vertical location of each item of the Work; for example, “embedded in slab”, “under slab”, “in ceiling plenum”, “exposed”, and similar designations. For piping, not embedded, indicate the elevation dimension relative to the Project elevation datum.

.3 Descriptions shall be sufficiently detailed to be related to the Specifications.

.4 Engineer may furnish written waiver of requirements relative to schematic layouts shown on plans, sections, and elevations when, in Engineer’s judgment, dimensioned layouts of Work shown schematically will serve no useful purpose. Do not rely on such waiver(s) being issued.

.5 Supplemental Drawings:

.1 In some cases, drawings produced during construction by the Engineer or Contractor supplement the Drawings and shall be included with Project record documents submitted by the Contractor. Supplemental record drawings shall include drawings or sketches that are part of Change Orders, Work Change Directives, Field Orders, and allowance authorizations and that cannot be incorporated into the Drawings because of space limitations.

.2 Supplemental drawings submitted with record drawings shall be integrated with the Drawings and include necessary cross-references between drawings. Supplemental record drawings shall be on sheets the same size as the Drawings.

.3 When supplemental drawings developed by Contractor using computer-aided drafting/design (CAD), building information models (BIM), or civil information models (CIM) software are to be included in record drawings, submit electronic files for such drawings as part of record drawing Submittal. Label such files, "Supplemental Record Drawings", including with Contractor's name, Project name, and Contract designation.

.3 Specifications and Addenda:

.1 Mark each Specifications section to record:

.1 Manufacturer, trade name, catalogue number, and Supplier of each material and equipment item actually furnished.

.2 Changes made by Addendum, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.

1.7 OPERATIONAL AND MAINTENANCE DOCUMENTS

.1 Equipment Operation and Maintenance Manual Content:

.1 Provide the following detailed information, as applicable:

.1 Use equipment tag numbers from the Contract Documents to identify equipment and system components.

.2 Maintenance instructions, including lubrication instructions if applicable

.3 Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project; delete or cross out information that does not specifically apply to the Project.

.4 Factory and field test data and performance curves (if applicable).

.5 Copy of the equipment manufacturer's warranty meeting the requirements of the Contract.

.2 Additional information as required in the associated equipment or system Specification Section.

.3 Include in Submittal the final configured control setpoints and similar configurable parameters provided in the equipment.

.2 Electronic submittals:

.1 Submit as Electronic Documents (in portable document format, PDF files) by Electronic Means.

2. PRODUCTS - (NOT USED)

3. EXECUTION - (NOT USED)

END OF SECTION

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SECTION 03100 CONCRETE FORMWORK AND FALSEWORK

1. GENERAL

1.1 SCOPE OF WORK

1. All formwork for cast-in-place concrete.

1.2 RELATED WORK

1. Concrete Reinforcement Section 03200
2. Cast-In-Place Concrete Section 03300

1.3 SUBMITTALS FOR INFORMATION ONLY

1. Contractor to bear full responsibility for all concrete formwork and falsework design, materials and construction.
2. Formwork and falsework to be designed and inspected in accordance with WCB requirements and "CAN/CSA-S269.3-M92 (R2013) - Concrete Formwork" by a Professional Engineer, registered in the Province of British Columbia, retained by the Contractor

2. PRODUCTS

2.1 MATERIALS

1. Formwork materials: to CSA S269.3 except as noted:
    1. Concrete exposed to view: sanded overlaid DFP to CSA O121.
    2. Concrete exposed to sewage or to be sandblasted: steel or sanded overlaid DFP to CSA O121.
2. Form Ties:
    a) Twisted wire ties are not acceptable.
    b) Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
3. Form Release Agent:
    a) Non-staining type containing compounds that react with free lime present in concrete preventing concrete from sticking to forms. Agent to be compatible with subsequent surface treatments.
4. Comply with CSA S269.1 and CSA S269.3 for falsework drawings.
5. Falsework materials: to CSA S269.1.
6. Joint Filler:
    a) 12 mm thick asphalt impregnated joint filler.

3. EXECUTION

3.1 GENERAL

1. Supply, erect and maintain all forms to confine concrete within neat lines shown on drawings.
2. Forms shall be so constructed that finished concrete surfaces shall be of uniform texture.

3.2 ERECTION

1. Verify lines, levels and column locations before proceeding with formwork and ensure dimensions agree with drawings.

2. Do not use earth forms.
3. Construct formwork in accordance with CSA A23.1-14 and CSA S269.3.
4. Construct falsework in accordance with CSA S269.1.
5. Obtain Engineer's approval before framing openings not indicated in concrete joists, beams or columns.
6. Align form joints and make watertight. Keep form joints to minimum.
7. Locate "window" openings in forms on inside face if above backfill level.
8. Use 20 mm chamfer strips on external corners of beams, walls and columns.
9. Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
10. Clean formwork and reinforcement with high pressure air before placing concrete.
11. Apply form release agent prior to form erection. Under no circumstances should concrete reinforcement be sprayed with form release agent
12. Apply form release agent in accordance with manufacturer's recommendations.
13. Leave formwork in place for following minimum periods of time after placing concrete. The intervals given refer to the number of days during which the air in contact with the concrete is above 10°C and the concrete is kept continually moist:
    a) 7 days for walls.
    b) 3 days for columns.
    c) 7 days for beam soffits, slabs, decks and other structural members with spans less than 6 metres. Spans greater than 6 metres to be 28 days unless proven by calculation or test that damage or excessive deflection will not occur.
    d) 7 days for footings and base slabs.
    e) Time periods for walls and columns may be reduced to 48 hours if acceptable curing, cold weather protection and bracing is provided. Submit proposal for review by Engineer.
14. Fill holes in accordance with repair specification in Section 03300.
15. Take all necessary precautions to prevent future leakage or seepage along ties in all walls which will be subjected to water pressure.
16. Immediately before concrete is placed, take precautions to see that all forms are in proper alignment, are mortar-tight, and that all form supports are secure and tight.
17. Re-use of formwork subject to adequate cleaning provided the faces have not become cracked or roughened. Patch or trim cracked or roughened faces to the satisfaction of the Engineer prior to reuse.
18. Slip forming may be permitted by Engineer subject to evaluation of procedures and mechanical equipment proposed for use.
19. Form Removal to Section 03300 - Cast in Place Concrete
20. Remove forms with care so as to avoid injury to concrete. Make good to satisfaction of Owner any damage arising from removal of forms.

3.3 CONSTRUCTION

1. Chamfers approximately 19 mm by 19 mm or as shown shall be formed at all concrete edges and re-entrant corners unless otherwise shown on the drawings or as required by the Corporation.
2. Where embedded rods, snap-ties or other similar devices are used for holding forms, they shall remain embedded and shall terminate at least 25 mm back from the formed face of the concrete,

leaving holes of regular shape for reaming; the holes shall be filled in accordance with Section 03300 and 03600.
3. Twisted wire ties shall not be used.
4. Wooden spreaders, if used, shall not deface or deform the formwork and shall be removed as concreting operations proceed.
5. At the time the concrete is placed in the forms, the surface of the forms shall be free from encrustations of mortar, grout or other foreign matter.
6. All dirt, chips, sawdust and other foreign matter shall be removed from within the forms before any concrete is deposited therein.
7. Before concrete is placed, the surface of the forms shall be oiled with a commercial form oil that will effectively prevent sticking and will not stain the concrete surfaces.
8. Immediately before concrete is placed; precautions shall be taken to see that all forms are in proper alignment and are mortar-tight, and that all form supports are secure and tight.
9. Cone ties shall be used on all exposed surfaces to be sandblasted or bush hammered.
10. Cones to be left in concrete until after surface treatment to prevent spalling.
11. Exposed tie rod ends shall be painted with “Galvacon” and 25 mm dia. holes plugged with lead to within 12 mm of the surface.
12. Lead plugs shall be cone tie lead cone plugs by Metal Distributors, Burnaby, B.C., or equal.
13. Cone ties to be located in a regular horizontal and vertical pattern as shown on drawings or directed by the Corporation. Otherwise tie holes in base of cone holes to be filled with non shrink grout.
14. Do not fill cone holes unless directed.

3.4 CLASSES OF FORMS

1. Forms shall be of the following classes and for the following uses:

    a) Class I: Class I forms shall be of a new waterproof synthetic resin-bonded plywood specifically made for concrete work, and shall be constructed with particular care to ensure a high type of architectural discolouration.
    b) Class II: Class II forms shall be waterproof, synthetic resin-bonded plywood specially made for concrete work, hardboard or steel. The Contractor will be permitted to use the most advantageous panel sizes and panel joint locations. Class II forms shall be used for all exposed concrete surfaces where Class 2 finish is specified in Section 03300.

3.5 TOLERANCES

1. Tolerances shall conform to CSA-A23.1-14, as follows.
2. Tolerances shall apply to true lines and grades which shall include chamfer shown on drawings prior to removal of forms. Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances shown below:

Location	Tolerances
Walls, columns, alignment of outside face, top elevation, and thickness, including thickness of suspended and grade slabs	A23.1 – Clause 6.4 unless shown otherwise on drawings

Suspended Slabs Top Elevation	CSA-A23.1, Clause 7.5.1 and Table 22 Class A unless shown otherwise on drawings
Slabs on Grade Top Elevation	CSA-A23.1, Clause 7.5.1 and Table 22 Class A unless shown otherwise on drawings

3. Slab finish tolerances shall be determined in accordance with CSA-A23.1-14, Clause 7.5.1.

End of Section

SECTION 03150 CONCRETE ACCESSORIES

1. GENERAL

1.1 SCOPE OF WORK

1. All accessories for cast-in-place concrete.

2. PRODUCTS

2.1 MATERIALS

Use the following products unless noted otherwise on structural drawings.

1. Bearing pads: commercial grade neoprene, Durometer 60 with thicknesses and areas specified on drawings.
2. Joint sealant to be Sikaflex 2C, concrete grey or approved equal. Apply in accordance with the manufacturer's recommendations. Prime joint surfaces with Sikaflex Primer 429 before applying the sealant. Joint sealant to be installed in such a way that no break occurs in the continuity of the seal.
3. Backer rod: closed cell vinyl with 90% recovery after 50% compression. Size and thickness as shown.
4. Inserts: malleable iron, galvanized steel or stainless steel to AISI Type 304 or Type 316. Type, sizes and number as shown.
5. Weep hole tubes: plastic.
6. Dovetail anchor slots: to be minimum 0.6 mm thick galvanized steel with insulation-filled slots.
7. Anchor bolts: refer to Section 05501.
8. Compression seals: 50 mm, double cell, epoxy bonded neoprene gasket. Typical products: Jeene joint type 2W by Hydrozo/Jeene Incorporated.
9. Epoxy bonding agent: A two component epoxy resin. Typical product: Sikadur 32 Hi-Mod by Sika Products; MasterEmaco ADH 326 by Master Builders ; Duralbond by Tamms.
10. Grout for dowels: A two component epoxy resin. Typical product (overhead or horizontal): Sikadur 31 Hi Mod Gel; Duralcrete Gel by Tamms - (vertical) Sikadur 31 or 35; MasterEmaco ADH 326 by Master Builders ; Duralcrete LV by Tamms.
11. Stair nosing: Aluminum with integrally cast abrasive for slip resistance and concealed integral anchors. Typical product: Alumogrit Safety Tread Type 101 by Wooster Products Inc.; Surefoot Style No. 1004 by Globe Foundry Ltd.
12. Polymer Modified Patching Material: A two component cementitious mortar for horizontal and vertical concrete repair. Typical products: Masterpatch by Master Builders, Sikatop by Sika.
13. Expansion Joint – Resilient Filler: Expansion joint filler shall be DECK-O-FOAM Expansion Joint Filler from W. R. Meadows, or equal. Joint filler and sealant to be compatible.

3. EXECUTION

3.1 BEARING PADS

1. Install in locations shown on drawing. Surfaces to be clean and dry prior to placement.

3.2 COMPRESSION SEALS

1. Shop fabricate tees and crosses. Splice to manufacturer's directions.
2. Install in strict conformance with manufacturer's requirements.
3. Lubricant and adhesive to manufacturer's recommendations.
4. Test seal for leaks prior to installation into joints.

3.3 EPOXY RESINS AND POLYMER MODIFIED PATCHING MATERIALS

1. Use correct formulations for area and position of application.
2. Mix, apply and cure in strict accordance with manufacturer's instructions and recommendations.

3.4 DOWELS

1. Core drill to a depth to clear existing reinforcement and use a percussive drill to create required embedment depth. If cored full depth, roughen hole by sandblasting, shotblasting or mechanical abrasion to provide bonding surface for grout.

End of Section

SECTION 03 15 19
ANCHORAGE

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Requirements for all cast-in-place anchor bolts, anchor rods, reinforcing anchorage adhesive, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.

.2 Design of all concrete anchors not indicated on the Drawings including, but not limited to, installation of anchors into concrete for the following structural and nonstructural components:

.1 Structural members and accessories.

.2 Metal, wood, and plastic fabrications.

.3 Architectural components.

.4 Mechanical and electrical equipment and components.

.5 Plumbing, piping, and HVAC work.

.6 All other components requiring attachment to concrete.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Section 40 05 07 - Pipe Support Systems.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Concrete Institute (ACI):

.1 318, Building Code Requirements for Structural Concrete and Commentary.

.2 355.2, Seismic Testing of Post-Installed Concrete and Masonry Anchors in Cracked Concrete.

.3 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.

.2 American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):

.1 Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.

.3 American Institute of Steel Construction (AISC):

.1 303, Code of Standard Practice for Steel Buildings and Bridges.

.4 ASTM International (ASTM):

.1 A36, Standard Specification for Carbon Structural Steel.

.2 A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

.3 A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.4 A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.5 A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.6 A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

.7 A563, Standard Specification for Carbon and Alloy Steel Nuts.

.8 A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

.9 F436, Standard Specification for Hardened Steel Washers.

.10 F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.11 F594, Standard Specification for Stainless Steel Nuts.

.12 F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

.13 F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

.5 Canadian Standards Association

.1 CSA A23.1/ CSA A23.2, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

.6 National Building Code of Canada

.1 NBC 2020

.7 ICC Evaluation Service (ICC-ES):

.1 AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.

.2 AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

.2 Qualifications:

.1 Anchor designer for Contractor-designed post-installed anchors and cast in place anchorage shall be a professional engineer licensed in the Province of British Columbia.

.2 Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.

.3 Post-installed anchors and related materials shall be listed by the following agencies:

.1 ICC-ES.

.2 Engineer approved equivalent.

1.3 DEFINITIONS

.1 Adhesive Anchors:

.1 Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.

.2 Includes anchors using acrylics, epoxy and other similar adhesives.

.2 Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.

.3 Anchor Rod: Any cast-in-place or post-installed anchorage made from unheaded, threaded, rod or deformed bar material.

.4 Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.

.5 Galvanizing: Hot-dip galvanizing per ASTM A123, ASTM A153 or ASTM F2329 with minimum coating of 2.0 oz of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

.6 Hardware: As defined in ASTM A153 or ASTM F2329.

.7 Installer or Applicator:

.1 Installer or applicator is the person actually installing or applying the product in the field at the Project site.

.2 Installer and applicator are synonymous.

.8 MPII: Manufacturer's printed installation instructions.

.9 Mechanical Anchors:

.1 Post-installed anchors developing their strength from attachment other than thru adhesives or chemical bond to concrete.

.2 Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.

.3 Drop-in anchors and other similar non-ICC ES approved anchors are not allowed.

.10 Post-Installed Anchor: Any adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Acknowledgement that submitted products meet requirements of referenced standards.

.2 Manufacturer material data sheet for each anchor.

.1 Clearly indicate which products on the data sheet are proposed for use on the Project.

.3 Manufacturer's printed installation instructions.

.4 Current ICC-ES report for each post-installed anchor system indicating the following:

.1 Certification that anchors meet all requirements indicated in this Specification.

.2 Performance data showing that anchor is approved for use in cracked concrete.

.3 Seismic design categories for which anchor system has been approved.

.4 Required installation procedures.

.5 Special inspection requirements for installation.

.5 Contractor Designed Anchors:

.1 Show diameter and embedment depth of each anchor.

.2 Indicate compliance with CSA Concrete Design

.3 Design tension and shear loads used for anchor design.

.4 Engineering design calculations:

.1 Indicate design load to each anchor.

.2 Develop anchor forces based on Design Criteria listed herein and/or manufacturer's design information.

.5 Provide torque values where pipe sleeves anchors are used.

.6 Anchorage layout drawings and details:

.1 Indicate anchor diameter, embedment, length, anchor type, material and finish.

.2 Drawings showing location, configuration, spacing and edge distance.

.3 Type of post-installed anchor system used.

.1 Provide manufacturer's ICC-ES report for the following:

.1 Mechanical anchorage per ICC-ES AC193.

.2 Adhesive anchorage per ICC-ES AC308.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver products to job site in manufacturer's or distributor's packaging undamaged and complete with installation instructions.

.2 Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

.3 Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

2. PRODUCTS

2.1 MATERIALS

.1 Cast-in-place Concrete Anchors:

.1 Building and nonbuilding structures, unless otherwise specified:

.1 ASTM F1554, Grade 36 or Grade 55 with weldability supplement S1 for galvanized threaded rods.

.2 ASTM A307, Grade A for galvanized headed bolts.

.3 For Submerged or used in enclosed tankage, ASTM F593, Type 316.

.1 All other cast-in-place concrete anchors for equipment:
  .1 Stainless steel with matching nut and washer.
  .2 Submerged application: ASTM F593, Type 316.
  .3 Non-submerged application: ASTM F593, Type 304 or Type 316 anchors and washers
  .4 Nuts for non-submerged applications, ASTM563 and coated after torqued.

.2 Post-Installed Mechanical and Adhesive Concrete Anchors:
  .1 Stainless steel with matching nut and washer.
  .2 Submerged application: ASTM F593, Type 316.
  .3 Non-submerged application: ASTM F593, Type 304 or Type 316, with ASTM A563 nuts coated after torquing.

.3 Reinforcement: See Section 03 20 00.

.4 Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

.5 Deformed Bar Anchors: ASTM A496 with minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

.6 Washers:
  .1 ASTM F436 unless noted otherwise, finish to match bolt.
  .2 If stainless steel anchorage is being used for cast-in-place anchorage, furnish washers of the same material and alloy as in the accompanying anchorage.
  .3 Plate washers: Minimum 1/2 inches thick fabricated ASTM A36 square plates as specified or required.
  .4 Follow manufacturer's requirements for all post-installed anchorage.

.7 Nuts:
  .1 ASTM A563 for all cast-in-place anchorage.
  .2 If stainless steel anchorage is being used for cast-in-place anchorage in submerged or enclosed tankage, nuts shall meet ASTM F594 and be the matching material and alloy as in the accompanying anchorage.
  .3 Follow manufacturer's requirements if using post-installed anchorage.

.8 Galvanizing Repair Paint:
  .1 High zinc dust content paint for regalvanizing welds and abrasions.
  .2 ASTM A780.
  .3 Zinc content: Minimum 92% in dry film.
  .4 ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."

2.2 CONTRACTOR DESIGNED ANCHORAGE

.1 Manufacturers:

.1 Post-installed anchor systems for the listed manufacturers will be considered only if a current ICC-ES evaluation report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section and if the anchor system is approved by the Engineer.

.1 Hilti.

.2 Dewalt.

.3 Simpson Strong-Tie.

.2 Design the anchorage when any of the following occur:

.1 Design load for concrete anchorage is shown on the Drawings.

.2 When specifically required by the Contract Documents.

.3 When an anchorage is required but not specified in the Drawings.

.3 Anchorage Design Loads:

.1 Determine all of the design loads, including wind and seismic loads, per the building code. Additionally, specialty engineer is required to incorporate all static and dynamic loading forces established by the equipment manufacturer, where required for equipment.

.1 Anchorage of equipment and non-structural components: Use the actual dead and operating loads provided by the manufacturer.

.4 When Contract Drawings indicate an anchor diameter or length, design shall incorporate these as "minimums." Design these anchors and provide all necessary documentation as required herein.

.5 Cast-in-Place Concrete Anchors:

.1 Provide the material, nominal diameter, embedment length, spacing, edge distance and design capacity to resist the calculated load based on the requirements given in the building code including.

.2 Design assuming cracked concrete.

.6 Post-installed Concrete Anchors:

.1 Provide the manufacturer's system name/type, nominal diameter, embedment depth, spacing, minimum edge distance, cover, and design capacity to resist the specified or calculated load based on requirements given in the National Building Code or applicable Provincial Building Code.

.2 Design assuming cracked concrete.

2.3 ENGINEER DESIGNED ANCHORAGE

.1 When the size, length and details of anchorages are shown on Contract Structural Drawings, Contractor design of anchorage is not required.

.2 Manufacturers:

.1 Additional newer post-installed anchor systems for the listed manufacturers will be considered only if a current evaluation agency report is submitted in accordance with the SUBMITTALS Article in PART 1 of this Specification Section, the anchor system is certified by ICC-ES for cracked concrete conditions, and if approved by the Engineer.

.2 Mechanical Anchors:

.1 Hilti:

.1 Kwik Bolt TZ (ICC-ES ESR-1917).

.3 Adhesive Concrete Anchors:

.1 Hilti:

.1 HIT RE 500 V3 (ICC ESR-3814).

3. EXECUTION

3.1 GENERAL

.1 Cast-in-Place Anchorage:

.1 Use where anchor rods or bolts are indicated on the Drawings, unless another anchor type is approved by the Engineer.

.2 Provide concrete anchorage as shown on the Drawings or as required to secure components to concrete.

.2 Adhesive Anchorage:

.1 Use only where specifically indicated on the Drawings or when approved for use by the Engineer.

.2 May be used where subjected to vibration or where buried or submerged.

.3 Do not use in overhead applications or sustained tension loading conditions such as utility hangers.

.4 Contact Engineer for approval when anchors will not be installed in compliance with MPII

.3 Mechanical Anchorage:

.1 Use only where specifically indicated on the Drawings or when approved for use by the Engineer.

.2 Do not use where subjected to vibration.

.3 May be used in overhead applications.

.4 Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.

.4 Do not use powder actuated fasteners and other types of bolts and fasteners not specified herein for structural applications unless approved by the Engineer or specified in Contract Documents.

3.2 PREPARATION

.1 Provide adequate time to allow for proper installation and inspection prior to placing concrete for cast-in-place concrete anchorage.

.2 Prior to installation, inspect and verify areas and conditions under which concrete anchorage is to be installed.

.1 Notify Engineer of conditions detrimental to proper and timely completion of work.

.2 Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

.3 Special Inspection is required in accordance with the building code for all concrete anchorage.

.1 Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).

.2 See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section for additional requirements.

.4 Post-installed anchor manufacturer's representative shall demonstrate and observe the proper installation procedures for the post-installed anchors at no additional expense to the Owner.

.1 Follow such procedures to assure acceptable installation.

.2 Adhesive anchors must be installed in concrete aged a minimum of 21 days.

3.3 INSTALLATION

.1 Tie cast-in-place anchorage in position to embedded reinforcing steel using wire.

.1 Tack welding of anchorage is prohibited.

.2 Chase threads as required and coat the projected portion of carbon steel anchors and nut threads with a heavy coat of clean grease after concrete has cured.

.3 Anchorage location tolerance shall be in accordance with AISC 303.

.4 Provide steel or durable wood templates for all column and equipment anchorage.

.1 Templates to be placed above top of concrete and not impede proper concrete placement and consolidation.

.2 Unless noted or specified otherwise:

.1 Connect aluminum and steel members to concrete and masonry using stainless steel cast-in-place anchorage unless shown otherwise.

.1 Provide dissimilar materials protection.

.2 Provide washers for all anchorage.

.3 Where exposed, extend threaded anchorage a maximum of 3/4 inches and a minimum of 1/2 inches above the top of the fully engaged nut.

.1 If anchorage is cut off to the required maximum height, threads must be dressed to allow nuts to be removed without damage to the nuts.

.3 Do the following after nuts are snug-tightened down:

.1 If using post-installed anchorage, follow MPII.

.2 Upset threads of anchorage to prevent nuts from backing off.

.1 Provide double nut or lock nut in lieu of upset threads for items that may require removal in the future.

.3 For all other cast-in-place anchorage material, tighten nuts down an additional 1/8 turn beyond snug tight to prevent nuts from backing off.

.4 If two nuts are used per concrete anchor above the base plate, tighten the top nut an additional 1/8 turn to "lock" the two nuts together.

.5 If using post-installed anchorage, follow MPII.

.4 Assure that embedded items are protected from damage and are not filled in with concrete.

.5 Secure architectural components such that it will not be aesthetically distorted and fasteners will not be overstressed from expansion, contraction, or installation.

.6 Coat aluminum surfaces in contact with dissimilar materials.

.7 Repair damaged galvanized surfaces in accordance with ASTM A780.

.1 Prepare damaged surfaces by abrasive blasting or power sanding.

.2 Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions and ASTM A780.

.8 For post-installed anchors, comply with the MPII on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar.

.1 Use hammer drills to create holes.

.2 Properly clean out the hole per the ICC-ES reports utilizing a non-metallic fiber bristle brush and compressed air or as otherwise required to remove all loose material from the hole prior to installing the anchor in the presence of the Special Inspector.

3.4 FIELD QUALITY CONTROL

.1 Field Inspection and Testing

.1 Owner reserves the right to inspect and test completed anchorage at a minimum of 10% (for large quantity) to 25% (smaller quantity) to 100% (very small project quantity).

.2 Failed anchors shall be satisfactorily replaced at no cost to Owner.

3.5 CLEANING

.1 After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.

.2 Provide surface acceptable to receive field applied paint coatings when specified in Specification Section 09 91 10.

END OF SECTION

SECTION 03200 CONCRETE REINFORCEMENT

1. GENERAL

1.1 SCOPE OF WORK

1. All concrete reinforcement for cast in place and precast structures.

1.2 RELATED WORK

1. Concrete Formwork and Falsework Section 03100
2. Cast-In-Place Concrete Section 03300

1.3 SUBMITTALS FOR INFORMATION ONLY

1. Submit shop drawings stamped by a professional engineer in accordance with Section 01330, Submittals.
2. Shop drawings to comprise: bar bending details, lists and placing drawings. Submit entire information in a single submittal for each concrete pour.
3. On placing drawings, indicate: bar sizes, bar spacing, location and quantities of reinforcement and mechanical splices, dimensions of laps and embedment lengths. Detail identifying code marks to permit correct placement without reference to structural contract drawings. Indicate sizes, spacing and location of chairs, spacers and hangers. Do drawings in accordance with Reinforcing Steel Manual of Standard Practice.
4. Detail lap lengths and bar development lengths as shown on detail drawings and standard details.

1.4 SUBSTITUTES

1. Substitution of different size bars permitted only upon written approval of Engineer.

1.5 QUALITY CONTROL

1. Provide Engineer with certified copy of mill test report of reinforcement, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcing work. Ensure QA program can trace reinforcement on site to applicable mill test report.
2. Upon request inform Engineer of proposed source of material to be supplied.

2. PRODUCTS

2.1 MATERIALS

1. All reinforcement to be Grade 400, Type W deformed bars to CSA G30.18.
2. Welded deformed steel wire fabric: to CSA G30.15. Provide in flat sheets only.
3. Welded wire fabric to CSA G30.5 For Welded Steel Wire Fabric For Concrete Reinforcement.
4. Chairs, bolsters, bar supports, spacers: Stainless Steel, plastic coated steel or plastic to CSA-
5. A23.1. Precast concrete blocks with embedded wires subject to approval of Engineer.
6. Mechanical Coupler: low carbon steel conforming to a recognized standard. Coupler to develop in tension or compression a minimum of 125 percent of the specified yield strength of the bar to be spliced. Maximum slip of bars in coupler after loading to 200 MPa and relaxing to 20 MPa to be 0.25 mm. Splices which involve crimping or welding are not acceptable. Typical products for future

tie-ins: Lenton Form Saver. Typical products for splices: Lenton Standard Coupler, Bar Lock MBT Coupler.

7. Plain round bars: to CAN/CSA-G40.21.

2.2 FABRICATION

1. Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice.
2. Cut and cold bend bars accurately to required sizes and shapes in accordance with CSA-A23.3.
3. Obtain Engineer's approval for locations of reinforcement splices other than shown.
4. Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

3. EXECUTION

3.1 GENERAL

1. Welding of reinforcement is not permitted unless authorized by the Engineer.

3.2 FIELD BENDING

1. Bend bars accurately to required sizes and shapes in accordance with CSA-A23.3.
2. Do not field bend reinforcement except where indicated or authorized by Engineer.
3. When field bending is authorized, bend without heat, applying a slow and steady pressure.
4. Replace bars which develop cracks or splits.

3.3 PLACING REINFORCEMENT

1. Place reinforcement as indicated on submitted placing drawings and in accordance with CSA-A23.1.
2. Position accurately and secure against displacement by tying with annealed iron wire or fixing with suitable wire clips at alternate intersections.
3. Use plain round bars for slip dowels in concrete.
4. Clean reinforcements thoroughly of all scale, loose dirt or concrete, or any other objectionable matter that might reduce bonding with concrete.
5. Do not spray form release agent in the vicinity of reinforcing bars.
6. Placing tolerances to conform to CSA A23.1.
7. Provide additional bars as required to ensure adequate support of reinforcement, and to the satisfaction of the Engineer.
8. Provide certification in accordance with agreed quality assurance program, that reinforcement has been correctly placed in accordance with submitted placement drawings and that placement drawings are in agreement with Contract Documents.
9. Prior to closing forms and placing concrete, obtain Engineer's acceptance of completed installation of reinforcement. Inspection in-place and instructions resulting from such inspection will take precedence over previous instructions or reviews.
10. Use mechanical couplers only where shown unless otherwise authorized by Engineer. Couplers to be placed to ensure deviation in alignment of spliced reinforcement is no greater than 5 mm over 1000 mm.
11. Place and support reinforcement in such a manner as to prevent damage to waterproofing membrane which has been previously applied or constructed.
12. Reinforcement to be shop-bent or slightly relocated where necessary to avoid waterstop.
13. Reinforcement is not to be placed or forced into fresh concrete.

14. Splices are not permitted except where shown on drawings or approved by Engineer. Welded splices will not be permitted.
15. In addition to support shown on the approved placing drawings, provide sufficient extra bar supports for additional support where in opinion of Engineer specified clearances are not being maintained.

End of Section

SECTION 03300 CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 SCOPE OF WORK

1. Construction of all reinforced and non-reinforced concrete structures.
2. Refer to geotechnical report.

1.2 SUBMITTALS FOR REVIEW

1. At least thirty (30) days before the start of each type of concrete work submit to the Engineer for review the following items in accordance with Section 01330 (Submittals):
    1. Source of concrete.
    2. Source of cementitious materials, including certification that materials conform to CSA A23.1-14.
    3. Source of aggregate(s), including test reports dated within one year of the start of construction, demonstrating that the aggregates meet the requirements of CSA A23.1-14, Tables 10, 11 and 12 <including assessment of alkali-aggregate reactivity. The Engineer, at his or her discretion, may require samples of the proposed aggregate(s) to be supplied by the contractor, at the contractor's expense, for independent testing.
    4. Proposed admixtures, including types, brand names, manufacturer's technical and certification data.
    5. Proposed mix design for each concrete type. See 2.2.3. stamped by a BC professional engineer
    6. Documentation demonstrating that the proposed mix designs for each type of concrete meet the specified strength and durability requirements.
    7. Proposed floor hardener, curing compound, concrete sealer and evaporation retardant. Brand names, manufacturer's technical and certification data are to be included.

2. PRODUCTS

2.1 MATERIALS

1. All materials used are to conform to the appropriate standards identified below.

    a) Portland cement: to CSA-A3001, Type GU, with C3A content of minimum 4% and maximum 8% of mass.
    8. Supplementary cementing materials: Pozzolan to CSA-A3001, Type F and CI Fly ash.
    9. Water - CSA-A23.1-04.
    10. Aggregates - CSA-A23.1-14. Normal density aggregates only.
    11. Aggregate gradations must comply with CSA A23.1 requirements.
    12. Air entraining admixture - ASTM C260.
    13. Chemical admixtures – ASTM C494/494M. Admixtures are to be chloride free.
    14. Superplasticizers – ASTM C1017/C1017M Admixtures are to be chloride free.
    15. Floor hardener: non-metallic, premixed, quartz, aggregate, coloured, abrasion resistant hardener as approved by the Engineer.

16. Floor sealer: A concrete curing and sealing compound. Typical product: Master Builders MB-429 as approved by the Engineer.
17. Curing compound: chlorinated rubber. Typical product: Master Builders-Masterkure (clear) as approved by the Engineer.
18. Evaporation retardant: Master Builders – MasterKure or as approved by the Engineer.
19. Concrete sealer: Sikalastic Duocel 421 epoxy sealer, Sika Floorseal WB 18 Water-Based
20. Acrylic Concrete Cure and Seal or similar.
21. Water reducing agent to conform to ASTM C.494 for chemical admixtures for concrete.
22. Patching mortar: Proprietary bagged patching mortar as approved by the Engineer.

2.2 CONCRETE MIXES

1. Concrete shall be supplied in accordance with CSA A23.1 – 14 Clause 4.1.2 and Table 5 Alternative 1.
2. Mix design submittals for each type of concrete are to be supplied to the Engineer and are to be sealed by a registered Professional Engineer hired by the contractor. The Engineer must approve all changes to these mixes. Should a change in material source be proposed, new mix designs must be submitted to the Engineer for review. Intended uses (locations) for each mix must be clearly identified on submissions.
3. Mix Design Submittal Requirements

   a) Prepare mix designs to A23.1-14, Table 5, Alternate 1.

   23. Submit the following prequalification data(3).

Concrete Type	Compressive Strength (1)	Air (1)	Slump (1)	RCP (2)	Linear Shrinkage (2)	Actual W/cm (1)
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes			
4	Yes	Yes	Yes			Yes
5	Yes	Yes	Yes			
6	Yes	Yes	Yes			

(1) Submittal shall include test results on at least 3 batches of the same mix design within 90 days of the date of submittal. Do trial batches if necessary.

(2) Submittal shall include test results on at least one batch of the same mix design within one year of the date of submittal.

(3) If any of the specified data are not available or cannot be submitted, the submittal shall include the proposed mix design for each concrete classification, indicating weight of each material per cubic meter. Include mortar rich mixes for wall pours as per Clause 3.6.1 of this Section.

4. The slump indicated is without superplasticizer and shall be measured at the time and point of discharge. Subject to approval by the Engineer, the slump may be increased above the indicated maximum by the addition of an approved superplasticizer. The superplasticizing admixture must not adversely affect the performance of the air-entraining admixture.

5. Concrete mix proportions are to be in accordance with CSA-A23.1-04 and provide the properties outlined in the following table.

Locations	Compressive Strength Mpa	Minimum Cement (kg)	W/C Ratio	Air Entrain %	Silica Fume (%)	Slump (mm) & Tolerance		Exposure Class	Cement Type
Interior Footings	35	320	0.5	1 to 4		80	± 30	N	G.U.
Exterior Footings	35	320	0.45	4 to 7		80	± 30	F-2	G.U.
Foundation walls (Exposed)	35	320	0.5	4 to 7		80	± 30	F-2	G.U.
Interior slab on grade	35	320	0.5	1 to 4		80	± 30	N	G.U.
Exterior slab on grade / pedestrian traffic	35	320	0.45	5 to 8		80	± 30	C-2	G.U.
Suspended slab and slab bands	35	320	0.4	5 to 8		80	± 30	F-2	G.U.
Interior walls & columns/pedestals	35	320	0.5	----		80	± 30	N	G.U.
Exterior walls & columns/pedestals	35	320	0.45	4 to 7		80	± 30	F-2	G.U.
Interior beams	35	320	0.5	----		80	± 30	N	G.U.
Exterior beams	35	320	0.45	4 to 7		80	± 30	F-2	G.U.
Masonry grout	20	320	0.60	3 to 5		175	± 25	N	G.U.
Watertight Concrete; Tank walls, columns, pedestals, Wet well	35	320	0.4	5 to 8	10	80	± 30	A-2	G.U.
Watertight Concrete; Tank base slab	35	320	0.4	5 to 8	10	70	± 20	A-3	G.U.
Topping Concrete - Interior	35	320	0.5	1 to 4	10	70	± 20	N	G.U.

Note:

Compressive Strength @ 28 Day u.n.o., Mpa

Minimum Cement Content per m3 of concrete (kg)

Silica Fume by Wt. Of Total Cementitious Material %

6. Admixtures shall not contain Calcium chloride.

3. EXECUTION

3.1 GENERAL

1. Obtain approval from the Engineer before placing concrete. Provide 24 hours notice prior to placing of concrete. If concrete is placed without approval or inspection, the Engineer may require tests to be done to demonstrate compliance with the design. These shall be at the Contractor's expense.

2. Prior to placing concrete, obtain the Engineer's approval of proposed method(s) for protection of concrete during placing and curing in adverse weather conditions.

3. Maintain accurate records of poured concrete items that indicate date, location of pour, quantity, air temperature, and any test samples taken. Submit a copy to the Engineer for information purposes.

3.2 PREPARATION

1. Verify requirements for concrete cover over reinforcement.
2. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause difficulty in placing of concrete.
3. Verify that conduits, pipes and ducts are placed as shown on the Drawings.
4. Verify that concrete may be placed to the lines and elevations shown on the Construction Drawings with all required clearances and cover for reinforcement.
5. Remove all standing water, dirt and debris prior placement of concrete.
6. For slabs-on-grade, place concrete on properly prepared and unfrozen sub-grade or forms and only in dewatered excavations and forms. Vapour barrier shall be placed, taped and secured prior to starting the slab pour. Vapour barrier sheets shall be lapped a minimum of 100 mm.

3.3 INSERTS

1. Set sleeves, ties, pipe hangers and other inserts and openings as shown or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not shown on structural or civil drawings must be approved by Engineer.
2. No sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where expressly detailed on structural or civil drawings or approved by Engineer.
3. Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Engineer before placing of concrete.

4. Check locations and sizes of sleeves and openings shown on structural drawings with civil, architectural, mechanical, HVAC and electrical drawings.

3.4 WORKMANSHIP

1. All concrete work is to be in accordance with CSA-A23.1-04, unless noted otherwise.
2. Work shall be free from all defects which may impair the strength, permeability, durability and appearance of the structure. All concrete which, in the opinion of the Engineer, is defective or inferior, shall be forthwith removed and replaced or otherwise remedied to the satisfaction of the Engineer
3. Provide 24 hours notice to the Engineer prior to the placement of concrete.
4. Ensure that reinforcement and inserts are not disturbed during concrete placement.
5. Obtain approval from the Engineer prior to pouring adjacent walls or slabs. .

3.5 PLACEMENT OF CONCRETE

1. All concrete shall be placed in the dry.
2. Handle, deposit and consolidate concrete in accordance with CSA-A23.1-04 Clause 7.2 and ACI 309R. Do not disturb forms or reinforcing steel when depositing and consolidating concrete.
3. Ensure that spare internal vibrators are on site and functioning correctly during placement of the concrete.

4. Unless authorized otherwise, where concrete will be placed against hardened concrete, bond the fresh concrete to the hardened concrete in accordance with CSA-A23.1-04, Clause 7.2.2.
5. When ambient temperature necessitates the use of hot or cold weather concreting, provisions are to be made in advance of concrete placement. During hot weather, concrete shall be placed in accordance with ACI 305R. During cold weather, concrete shall be placed in accordance with ACI 306R.
6. Do not begin to place concrete when the weather or other limitations prevent proper consolidation, finishing or curing.
7. Do not begin to place concrete while precipitation is falling unless adequate protection is provided. Do not allow precipitation to increase the water content of the mix or to damage the surface of the concrete.
8. The addition of water to the concrete after leaving the plant shall be done only with the approval of the Mix Designer and the Concrete Supplier, and shall be done in accordance with A23.1-04, Clause 5.2.4.3.
9. Avoid discharging concrete in a manner which will cause segregation. For free fall more than a 1.5m, a suitable chute or tube should be used to direct the flow of concrete vertically downwards.

3.6 CONSTRUCTION JOINTS

.1 General

1. Construction joints shall be in accordance with CSA-A23.1-04 Clause except as noted.
2. Locate construction joints as shown on drawings or as approved by the Engineer.
3. Form all construction joints to conform with details for key-ways, and shear keys, where shown on drawings, and make watertight.
4. Construction joints in watertight structures are to be constructed as follows:

.2 Reinforcement is to be continuous through the joint

1. Sandblasting or hydromilling shall be used to prepare construction joints to an amplitude of 5 mm. This operation shall be performed on the hardened concrete prior to forming the next placement. After sandblasting all loose particles shall be flushed from the surface of the joint using fresh water. Concrete surfaces shall be thoroughly wetted for a period of not less than one hour prior to concrete placement and any free-standing water shall be blown from the surface of the joint immediately prior to placement.
2. Wall construction joint in watertight structures to have a mix with an excess of mortar placed in accordance with CSA-A23.1, Clause 7.2.2. Submit proposed mix design for review prior to concrete placement.
3. A minimum of seven (7) calendar days shall elapse between pouring of adjacent concrete at construction joints.

3.7 PROTECTION AND CURING OF CONCRETE

.1 Protection

1. The Contractor shall protect all concrete against damage. The methods of protection and the equipment for protection of concrete shall be subject to the approval of the Engineer and shall comply with CSA A23.1-04, Clause 7.4.

2. Concreting in cold weather and the protection of concrete subjected to cold weather after placement shall be carried out in accordance with ACI Standard 306R "Cold Weather Concreting".
3. Concreting in hot weather and the protection of concrete subjected to hot weather after placement shall be carried out in accordance with ACI Standard 305R "Hot Weather Concreting".
4. The Contractor shall have a copy of the above-mentioned standards available for reference at the site.

.2 Curing of Concrete

1. In general, curing of concrete shall conform to CSA Standard A23.1 Clause 7.4.1.

2. All exposed concrete surfaces shall be moist cured for a minimum of 7 days immediately following placement of the concrete.

3. Loosen wall forms as soon as possible without damaging the concrete. Walls with forms left on shall have a soaker hose on top of the wall keeping the walls continuously wet.

4. Membrane-forming curing compounds shall not be used unless otherwise approved by the Engineer.

5. Concrete which develops surface cracks, spalling, chalking, inadequate strength, etc. due to improper or lack of curing shall be rejected, and shall be replaced at the expense of the Contractor.

3.8 BONDED TOPPING

1. Bonded toppings are to comply with CSA-A23.1-04 Clause 7.6.4 except as noted.
2. Slabs to receive topping concrete are to have exposed-aggregate finish achieved by green cutting or sandblasting.
3. Clean base course surface and keep continuously moist for minimum of 12 hours prior to placing topping.
4. Remove excess water from surface and allow surface to dry to a saturated-surface dry condition.
5. Place cement/sand bonding grout in accordance with CSA-A23.1, Clause 7.6.4.2.2.
6. Joints in topping shall match joints in base slab.

3.9 PATCHING / FINISHING OF FORMED SURFACES

.1 General

1. Patch and finish formed surfaces to CSA A23.1 Clause 7.7.2 except as noted.
2. Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius unless otherwise indicated.

.2 Patching

1. Cutback all ties embedded in concrete to a minimum depth of 38 mm.
2. Fill tie holes in other areas in accordance with CSA A23.1 Clause 7.7.2.
3. Repair honeycombed and defective concrete with method approved by Engineer.

.3 Finish Types

1. Class 1 - Rubbed Finish. Finish all formed concrete exposed to view with a rubbed finish to CSA A23.1. Clause 7.7.3.7.
2. Class 2 - Common Finish. Finish all formed concrete exposed to potable water to receive waterproofing with a common finish. Common finish to consist of smooth-form finish to CSA A23.1 Clause 7.7.3.6 plus the filling, repair or removal of all imperfections, defects or holes exceeding 3 mm in any dimension.
3. Class 3 - Rough Form-finish. Finish all formed concrete in contact with backfill with a rough form finish to CSA A23.1 -04 Clause 7.7.3.5.

3.10 FINISHING OF UNFORMED SURFACES

.1 General

1. Finish slabs to CSA A23.1-04 Clause 7.5 and finishing schedule detailed on Architectural drawings.
2. Do not sprinkle dry cement or dry cement/sand mixture over concrete surfaces.
3. Sawcut crack-control joints where noted on drawings to CSA A23.1 Clause 7.3.2.
4. Tolerance to be measured by Straight Edge method to CSA A23.1, Clause 7.5.1.2.

.2 Slab Finishes

1. Finish all slabs and floors to CSA-A23.1-04, Clause 7.5 and Table 22, as shown on drawings.
2. Steel trowel finish – finish all slabs and floors to a steel trowel finish, Class A unless otherwise noted.
3. Non-slip surface – finish non-slip surface using a broomed finish. Corrugations to be straight and square across the slab with a uniform, pleasing appearance to a depth not exceeding 3 mm. Finish edges and form control joints using approved techniques and tools. Finishing tolerance shall be Class A.
4. Hardened finish – finish slabs and apply hardener to manufacturer's recommendations, at the application rate shown on the drawings. Use maximum 3% entrained air. Finish tolerance shall be Class A.
5. Surfaces to receive a bonded topping shall be prepared in accordance with CSA-A23.1-04, Clause 7.6.4.
6. Rub exposed corners with carborundum to produce 3 mm radius unless noted otherwise.

.3 Miscellaneous Concrete Finishes

1. Exterior curbs: Steel troweled. Apply sealer in accordance with manufacturer's recommendations.
2. Interior exposed curbs and pads: Steel troweled.
3. Areas of curbs and pads covered with grout: Non slip.
4. All exterior surfaces exposed to view to receive sealer.

.4 Repair of Concrete Surfaces

1. Immediately following removal of formwork, concrete surfaces shall be inspected for defects.
2. All imperfections on the concrete surfaces shall be repaired to produce surfaces that conform to the requirements specified in Section 3.10.3 and 3.10.4.
3. Unless otherwise approved by the Engineer, repair of imperfections in formed concrete shall be completed within 24 hours after removal of the forms.

4. The holes left by removal of pipes, tie rods or other accessories shall be reamed with suitable toothed reamers and, after being cleaned, shall be neatly and solidly filled with dry patching in Section 03600.
5. All bulges and other projections on exposed surfaces shall be chipped and ground until a true smooth surface of matching colour and texture is obtained.
6. Where the filling of any pits or honeycombs that occur on exposed surfaces of concrete is considered by the Engineer to be objectionable from a standpoint of durability or appearance, such imperfections shall be repaired using the following method:

   a) Chip out all defective concrete, to a minimum depth 25 mm;
   b) saw cut, perpendicular to the surface, around the perimeter of the area to be patched to a depth of 15 mm – do not cut reinforcing steel;
   c) Pressure wash area with a minimum pressure of 5000 psi to remove grease, dirt and debris;
   d) At the time of patching the substrate receiving the patch shall be in a saturated-surface dry condition;

   e) Patch the area with dry patching mortar. The mix shall be such as to avoid colour variation in surface finishes exposed to view. The surface of the patch shall be smooth and flush with the surrounding concrete.

3.11 QUALITY

1. Quality control for the production of concrete and delivery shall be the responsibility of the Contractor.
2. Inspection and testing of concrete and concrete materials will be carried out by a CSA certified concrete Testing Laboratory:
   a) A compressive strength test will consist of three standard cylinders, one tested at 7 days and two at 28 days.
   24. For each 30 cubic meters, or portion thereof, placed in one day, three standard cylinders will be cast.
   25. Strength test for Type 2 concrete will consist of four cylinders, one tested at 7 days, one at 28 days and two at 56 days.
   26. Frequency of testing may be increased at Engineer's discretion.
3. Inspection or testing by the Testing Laboratory will not augment or replace the Contractor’s quality control nor relieve him of his contractual responsibility.
4. The Testing Laboratory will take additional test cylinders during cold weather concreting. These additional cylinders will be cured on job site under same conditions as concrete which they represent and tested at the designated ages.
5. Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.2.

.1 Repair of Structural Defects

1. If any concrete fails to meet specified strength requirements, the Client may order investigations and tests to further verify the strength of the concrete; tests may include testing of core drilled samples from completed structure or load testing of structure.

2. Cores for testing shall be obtained from locations designated by the structural engineer and tested in accordance with CSA-A23.2-04. If results of tests clearly meet specified requirements the cost of such sampling and testing will be borne by the Client, otherwise the cost will be charged to Contractor
3. Load testing and evaluation tests shall be carried out as described and specified in Chapter 20 of the ACI Building Code Requirements for Reinforced Concrete (ACI 318M). If the load tests portion of structure clearly meets all test criteria, cost of load testing shall be borne by the Client, otherwise cost of load testing shall be charged to Contractor.
4. All costs for remedial work will be borne by the Contractor.

End Of Section

SECTION 03600 GROUT

1. GENERAL

1.1 DESCRIPTION

1. This section specifies Portland cement-based grout for general applications such as equipment bases, and which are not specified in other Sections.

1.2 REFERENCE STANDARDS

1. Conform to the latest edition of the following reference standards in accordance with Section 01423:
   a) CAN/CSA A23.1, Concrete Materials and Methods of Concrete Construction.
   b) CAN/CSA A5, Portland Cement.
   c) CAN/CSA A23.5, Supplementary Cementing Materials.
   d) CAN3 A266.2, Chemical Admixtures for Concrete.

2. PRODUCTS

2.1 TYPICAL PRODUCTS

1. For equipment bases: Masterflow 713 or 928 by Master builders; Sika® M-Bed® grout; Horngrout by Tamms; Sikagrout 212 HP by Sika Products.
2. For general use: Set grout by Master builders; Sika® M-Bed® grout.

2.2 MATERIALS

1. Cement: to CAN/CSA A5 Type 10.
2. Supplementary cementing materials to CAN/CSA A23.5.
3. Water to CAN/CSA A23.1.
4. Chemical admixtures to CAN3 A266.2.
5. Shrinkage compensating grout. Premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents. Compressive strength to be minimum 35 MPa at 7 days.
6. Grout for concrete reinforcement to Section 03150, Concrete Accessories.

3. EXECUTION

3.1 PREPARATION

1. Maintain surfaces and ambient air temperature of minimum 10°C for a minimum period of 24 hours prior to, during, and 72 hours after application.
2. If grouting in exposed conditions, provide and maintain temporary weatherproof enclosures from inclement weather during preparation, grouting and curing.

3.2 MIXING

1. Mix grout dry and add water to bring mix to the correct consistency in a mechanical rotary mixer.
2. Mix premix grout in accordance with manufacturer's instructions.

3.3 INSPECTION

1. Notify Engineer 24 hours before commencing grouting operations.

3.4 PLACING

1. Roughen and clean contact surfaces and thoroughly wet with water prior to grouting.
2. Prepare grout no earlier than 10 minutes before use and place in final position within 30 minutes.
3. Ram dry pack against suitable back-up blocker when grout is installed dry.
4. Grout using procedures in accordance with manufacturer's recommendations which results in 100% contact over grouted area.
5. Grout under base plates to be installed to provide for full bearing. Remove all air pockets.
6. Finish and tool grout exposed to view in a workmanlike manner consistent with the finish of adjacent materials.
7. Continuously moist cure at temperature above 5°C for seven days and in accordance with manufacturer's recommendations.

End Of Section

SECTION 04050 MASONRY PROCEDURES

1. GENERAL

1.1 RELATED WORK

Mortar and Grout for Masonry	Section 04060
Masonry Accessories	Section 04090
Masonry Reinforcement and Connectors	Section 04080
Concrete Block Masonry	Section 04220

1.2 REFERENCE STANDARDS

1. Conform to the following reference standards in accordance with Section 01423, Reference Standards:
    1. CSA A179, Mortar and Grout for Unit Masonry.
    2. CAN3-A371, Masonry Construction for Buildings.

1.3 SUBMITTALS FOR REVIEW

1. Submit the following samples in accordance with Section 01330, Submittals:
    a) Two of each type of masonry unit specified.
    b) One of each type of masonry accessory specified.
    c) One of each type of masonry reinforcement and tie proposed for use.
    d) As required for testing purposes.

1.4 SUBMITTALS FOR INFORMATION ONLY

1. Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.

1.3 NOTICE TO ENGINEER

1. Notify Engineer, a minimum 24 hours prior to placing grout to allow inspection of rebar and insulation. Close cleanouts after inspection.

1.4 SHIPMENT, PROTECTION AND STORAGE

1. Deliver materials to job site in dry condition.
2. Keep materials dry until use, except where wetting of bricks is specified.
3. Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids and protect from damage.

2. PRODUCTS

2.1 MATERIALS

1. Masonry materials are specified in related Sections 04060, 04090 and 04220.

3. EXECUTION

3.1 WORKMANSHIP

1. Build masonry plumb, level, and true to line, with vertical joints in alignment. Construction tolerances to Clause 5.3 of CAN3-A371.

2. Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting. Use installers who are members in good standing of the Canadian Masonry Contractors Association.

3.2 EXPOSED MASONRY

1. Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

3.3 JOINTING

1. Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints.

2. Cutting

3.4 CUT OUT NEATLY FOR ELECTRICAL SWITCHES, OUTLET BOXES, AND OTHER RECESSED OR BUILT-IN OBJECTS.

1. Make cuts straight, clean, and free from uneven edges.

3.5 BUILDING-IN

1. Build in items required to be built into masonry.

2. Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

3. Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

3.6 SUPPORT OF LOADS

1. Use 30 MPa concrete Class B to Section 03300, where concrete fill is used in lieu of solid units.

2. Use grout to CSA A179 where grout is used in lieu of solid units.

3. Install building paper below voids to be filled with grout; keep paper 25 mm back from faces of units.

3.7 JOINTS

1. Leave spaces as shown on drawings. Do not use wedges.

2. Provide continuous control joints as shown or at maximum 9 m spacing.

3. Continue bond beam reinforcement through control joints. Cut alternate wire joint reinforcement.

3.8 EXISTING WORK

1. Make good existing work. Use materials to match existing.

3.9 TESTING

1. Inspection and testing will be carried out by Independent Testing Laboratory designated by Engineer in accordance with Section 01400, Quality Control.

2. Mortar and grout tests will be taken in accordance with CAN3-A371.

3.10 PROTECTION

1. Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

2. Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

3. Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

3.11 COLD WEATHER REQUIREMENTS

1. Supplement Clause 5.15.2 of CAN3-A371 with following requirements:

2. Maintain temperature of mortar between 5°C and 50°C until used.

3. No blockwork shall be laid on a falling thermometer when the temperature is below 4.5ºC nor on a rising thermometer when the temperature is below 1.5ºC. All blockwork shall be protected against freezing for a period of 48 hours after being laid.

3.12 HOT WEATHER REQUIREMENTS

1. Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

End of Section

SECTION 04060 MORTAR AND GROUT FOR MASONRY

1. GENERAL

1.1 REFERENCE STANDARDS

1. Conform to the following reference standards in accordance with Section 01423, Reference Standards:
    1. CSA A179, Mortar and Grout for Unit Masonry.

1.2 QUALITY ASSURANCE

1. Provide access for sampling of mortar and grout and in accordance with Section 01400, Quality Control.

2. PRODUCTS

2.1 MATERIALS

1. Mortar: CSA A179, Type S.
2. Use aggregate passing 1.18 mm sieve.
3. Colour: ground coloured natural aggregates.
4. Use Type S mortar based upon proportion specifications.

2.2 MATERIAL SOURCE

1. Use same brands of materials and source of aggregate for entire project.

2.3 GROUT

1. Grout: to CSA A179 Table 3.
2. Compressive strength: 20 MPa min. at 28 days.
3. Max. Aggregate size: 10 mm.
4. Slump: 200 - 250 mm.

3. EXECUTION

3.1 MIXING

1. Mix grout to semi-fluid consistency.
2. Incorporate admixtures into mixes in accordance with manufacturer's instructions.
3. Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 h nor more than 2 h then remix with sufficient water to produce mortar of proper consistency for pointing.
4. Discard all mortar which is more than 2-1/2 hours old.

3.2 INSTALLATION

1. Grout all beams, cores with reinforcement or embedded metal and as shown.

End of Section

SECTION 04080 MASONRY REINFORCEMENT AND CONNECTORS

1. GENERAL

1.1 RELATED WORK

Masonry Procedures	Section 04050
Mortar and Grout for Masonry	Section 04060
Masonry Accessories	Section 04090
Concrete Block Masonry	Section 04220

1.2 REFERENCE STANDARDS

1. Conform to the following reference standards in accordance with Section 01423, Reference Standards:
    1. CAN3-A370, Connectors for Masonry.
    2. CAN3-A371, Masonry Construction for Buildings.

2. PRODUCTS

2.1 MATERIALS

1. Connectors: to CAN3-A370.
2. Interior walls: corrosion resistant as shown.
3. Reinforcement: to CAN3-A371.

3. EXECUTION

3.1 INSTALLATION

1. Install masonry connectors and reinforcement in accordance with CAN3-A370 and CAN3-A371, unless indicated otherwise.

End of Section

SECTION 04090 MASONRY ACCESSORIES

1. GENERAL

1.1 RELATED WORK

Masonry Procedures	Section 04060
Masonry Reinforcement and Connectors	Section 04080
Concrete Block Masonry	Section 04220

1.2 REFERENCE STANDARDS

1. Conform to the following reference standards in accordance with Section 01423, Reference Standards:
    1. CAN3-A371, Masonry Construction for Buildings.

2. PRODUCTS

2.1 MATERIALS

1. Control joint filler: mineral wall batt insulation as shown on drawings or as otherwise indicated.
2. Nailing inserts: 0.6 mm thick purpose-made galvanized steel inserts for setting in mortar joints.

3. EXECUTION

3.1 CONTROL JOINTS

1. Install continuous control joint fillers in control joints at locations indicated.

3.2 NAILING INSERTS

1. Install nailing inserts in mortar joints at 400 mm on centre each way, for attachment of wall strapping where required.

End Of Section

SECTION 04220 CONCRETE BLOCK MASONRY

1. GENERAL

1.1 RELATED WORK

Masonry Procedures	Section 04050
Mortar and Grout for Masonry	Section 04060
Masonry Reinforcement and Connectors	Section 04080
Masonry Accessories	Section 04090

1.2 REFERENCE STANDARDS

1. Conform to the following reference standards in accordance with Section 01423, Reference Standards:
    1. CAN3-A165 Series, CSA standards on concrete masonry units.

2. PRODUCTS

2.1 MATERIALS

1. Standard concrete masonry units: to CAN3-A165.1.
    a) Classification: H/15/A/M.
    2. Size: modular.
    3. Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels and bond beams.

3. EXECUTION

3.1 GENERAL

1. Concrete Block: lay in accordance with the Recommended Practise for Laying Concrete Block as published by the Portland Cement Association.
2. Maintain storey poles and level lines at all times; raise same as the work proceeds.
3. Keep masonry units dry and protect while in storage on site and in place.
4. Cut units with masonry saw only.
5. TOLERANCES
    a) Dimensions and Locations of Elements:
        1. For dimensions in cross section or elevation do not vary by more than plus 12 mm or minus 6 mm.
        2. For location of elements in plan do not vary from that indicated by more than plus or minus 12 mm.
        3. For location of elements in elevation do not vary from that indicated by more than plus or minus 6 mm in a story height or 12 mm total.
    4. Lines and Levels:

i. For bed joints and top surfaces of bearing walls do not vary from level by more than 6 mm in 3 m, or 12 mm maximum.
ii. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 3 mm in 3 m, 6 mm in 6 m, or 12 mm maximum.
iii. For vertical lines and surfaces do not vary from plumb by more than 6 mm in 3 m, 9 mm in 6 m, or 12 mm maximum.
iv. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 3 mm in 3 m, 6 mm in 6 m, or 12 mm maximum.
v. For lines and surfaces do not vary from straight by more than 6 mm in 3 m, 9 mm in 6 m, or 12 mm maximum.
vi. For vertical alignment of exposed head joints, do not vary from plumb by more than 6 mm in 3 m, or 12 mm maximum.
vii. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1.5 mm except due to warpage of masonry units within tolerances specified for warpage of units.

5. C. Joints:

i. For bed joints, do not vary from thickness indicated by more than plus or minus 3 mm, with a maximum thickness limited to 12 mm.
ii. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 3 mm.
iii. For head and collar joints, do not vary from thickness indicated by more than plus 9 mm or minus 6 mm.
iv. For exposed head joints, do not vary from thickness indicated by more than plus or minus 3 mm.
v. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1.5 mm from one masonry unit to the next.

3.2 BUILD-IN

1. Masonry reinforcing, lintels, bolts, pipe sleeves, openings, conduits, brackets, etc., required by other trades.
2. Where wall-hung fixtures or fittings are shown, build-in backing for same.
3. Form all chases, slots, recesses and openings in masonry – do not cut out after replacing.

3.3 JOINTING

1. Running bond except where otherwise noted.
2. 10 mm rodded joint compressed with a long sled type circular pointing tool slightly larger in diameter than the thickness of the joint for interior blockwork, square recessed to match block scoring for exterior blockwork.

3.4 MASONRY REINFORCING

1. Install horizontal masonry reinforcing every 400 mm in height and 15 m vertical reinforcing for full height of wall every 600 mm and at corners and ends of walls. Vertical reinforcing shall be as per

drawings. All the cavities (cores) in the CMU wall must be filled with mortar. When located on an existing floor the vertical reinforcing shall be spliced to a 15 m dowel threaded into a Hilti anchor placed into the existing concrete floor. Lap all reinforcing 600 mm minimum.
2. Install first course of reinforcing in first course above foundation and openings.
3. "Wal-Lok" or equal corner sections shall be used in the building corners in conjunction with the "Wal-Lok" or "Dur-Lok" horizontal reinforcing.

3.5 THRU-WALL FLASHING

1. Under first course of exterior walls and at steel lintels.
2. Turn up minimum of 100 mm on side wall or as detailed
3. Drain by weep holes at 1,000 mm on centre.

3.6 ADDITIONAL REINFORCING

1. Install additional vertical and horizontal reinforcing as indicated on the structural drawings in all masonry walls.

3.7 METAL TIES

1. Install where masonry intersects with concrete; 400 mm on centres vertically and 600 mm on centres horizontally.

3.8 OPENINGS IN MASONRY

1. At openings up to 1,200 mm in width, reinforce grout filled lintel or bond beam units with 2-15 M bars. Reinforcing bars shall extend at least 600 mm beyond the opening.

3.9 INSULATION

1. Install rigid insulation as specified on the drawings.

3.10 PROTECTION AND CLEANING

1. Protect all masonry from damage. Replace all damaged masonry. Do not smear mortar on masonry and keep masonry clean during progress of work. Keep tops of work covered at night or during interruption and sweep off top surface before progressing. Keep masonry clean and free of mortar droppings.
2. After completion, thoroughly clean all masonry work and remove any dropped or splattered mortar from the finished work. Use fiber brushed or wooden scrapers only. Do not use metal tools. Clean soiled or spotted surfaces and point up joints where necessary. Cut out defective mortar joints, and refill solidly with mortar and tool as approved. Do not use muriatic acid without City approval.

3.11 MASONRY CRACKS

1. Make allowances for patching or otherwise repairing as directed by the City all cracks that appear in masonry work within twelve months after final acceptance of the work, provided that this does not include cracks caused by accident or malice after the City has accepted the building.
2. Completely rake out cracks and point with pointing mortar.

3.12 WATERPROOF COATING – CONCRETE BLOCK WALLS

1. All new exterior concrete block walls and split face block walls shall be finished with Fabrishield 653 clear sealer as distributed by Fabrikem or approved equal.
2. The coating shall be applied in strict accordance with the manufacturer’s specifications.
3. Prepare block surfaces in strict accordance with the manufacturer’s specifications.
4. Mark existing and adjacent materials including door frames, louvres, flashings, windows, etc. to ensure there is no overspray.

End of Section

SECTION 05 50 00
METAL FABRICATIONS

1. GENERAL

1.1 SUMMARY

.1 Furnish all labor, materials, tools, equipment, and services for miscellaneous Metal Fabrications, as indicated, in accordance with provisions of Contract Documents.

1.2 REFERENCES

.1 Refer to drawings for applicable Building Code.

.2 WorkSafe BC Standards.

.3 ASTM, American Society for Testing and Materials (ASTM):

.1 ASTM A6: General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling.

.2 ASTM A36: Standard Specification for Carbon Structural Steel.

.3 ASTM A48: Standard Specification for Iron Casting.

.4 ASTM A 53/A 53/M – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated and Welded and Seamless

.5 ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

.6 ASTM A500 Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.40 – Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181 Ready Mixed, Organic Zinc-Rich Coating.

.3 CAN/CGSB-1.108 Bituminous Solvent Type Paint.

.5 Canadian Standards Association (CSA International):

.1 CAN/CSA S16.1 Limit States Design of Steel Structures.

.2 CAN/CSA G 40.20/G 40.21 General Requirements for Rolled or Welded Structural Quality Steel.

.3 CAN/CSA G 164 Hot-Dip Galvanizing of Irregularly Shaped Articles.

.4 CSA W47.1 Certification of Companies for Fusion Welding of Steel.

.5 CSA W48 – Filler Materials and Allied Materials for Arc Welding.

.6 CSA W48.1 – Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.

.7 CSA W55.3 Resistance Welding Company Certification.

.8 CSA W59 Welded Steel Construction, (Metal Arc Welding).

.6 American National Standards Institution:

.1 ANSI A14.3-2008 American National Standards for Ladders – Fixed – Safety Requirements.

.7 Materials and operations standards:

.1 AAMA, Architectural Aluminum Manufacturer's Association.

.2 AISC, American Institute of Steel Construction.

.3 AWS, American Welding Society.

.4 NAAMM, National Association of Architectural Metals Manufacturers.

1.3 QUALITY ASSURANCE

.1 Perform work of this Section by a Contractor with a minimum two years' experience in the fabrication and working of metals including, cutting, bending, forming and finishing.

.2 Fabricators to be certified by the Canadian Welding Bureau in Accordance with CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

.3 Welding to conform to CSA W59.

1.4 DESIGN CRITERIA

.1 Design free-standing handrails and guardrails in all areas to meet minimum Code loading requirements. Loading on guardrails to conform to Code requirements for guardrails in public buildings.

.2 All handrail and guardrail connections welded construction.

.3 Provide handrails and railings to allow for thermal movements resulting from change in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections and other detrimental effects.

.4 Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

.1 Shop Drawings:

.1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcements, details, accessories and erection details.

.2 Indicate location, type size and extent of all welds. Splices not indicated on shop drawings will not be accepted.

.3 Indicate method of setting, sealing and securing, anchoring metal fabrications to structural support.

.4 Dimensions:

.1 Check dimensions for all miscellaneous metal items on site. Be responsible for the correctness of such measurements and report to the Consultant in writing prior to commencing work, all discrepancies between measurements at building and those shown on the drawings.

.2 Verify location of anchor bolts and embedded steel. Ensure that work prepared by other trades is at a proper elevation, on line, level and true.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Fabricate large assemblies to permit safe, easy handling to place of installation.

.2 Store assemblies above ground.

.3 Exercise care in handling, storing and installing all material to prevent bending, twisting or structural or visual damage.

.4 Correct damaged material; where damage cannot be repaired, replace the item at no additional cost to the Owner.

1.7 INSPECTION AND TESTING

.1 Allow access to place of work for the purposes of inspection.

.2 Prior to commencement of work provide a schedule of shop fabrication.

.3 The Consultant may reject at any time during the process of the work a piece of material for any member that they may find defective or not in accordance with the detailed drawings. The material may be rejected notwithstanding any previous acceptance and components so rejected shall be replaced at no expense to the Owner. In case of dispute, the decision of the Design Builder / Consultant shall be final.

.4 Inspection and testing of metal fabrications to be carried out by a certified testing laboratory in accordance with CAN/CSA S16.

.1 Testing agency to submit letters of assurance sealed by a professional engineer certified in British Columbia that the testing complies with the requirements of CAN/CSA S16, including the frequency of tests and that the structural steel complies with the project specifications and design requirements.

.2 Perform non-destructive critical welds testing.

.3 Contractor to pay for all testing.

1.8 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of service commencement.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Materials listed:

.1 Steel Sections and plates: to CAN/CSA G40.20, Grade 300W.

.2 Structural Sections: to CAN3-G40.22, Type 350W, Class C or H.

.3 Steel Pipe: to ASTM A53/A53M, standard weight, galvanized finish.

.4 Welding Materials: to CSA W59.

.5 Welding Electrodes: To CSA W48 Series.

.6 Bolts and Anchor Bolts: to ASTM A 307.

.2 Galvanizing Repair Paint: hot dipped galvanizing with zinc coating 600 g/m2 to CAN/CSA-G164.

.1 Base:

.1 Sherwin Williams.

.2 Optional:

.1 ZRC Worldwide.

.2 Sherwin-Williams.

.3 Shop Primer:

.1 Base:

.1 As recommended by finish coat manufacturer for substrate.

.2 Optional:

.1 Sherwin-Williams.

.3 Add other manufactured items used.

2.2 FABRICATION

.1 Form to shapes indicated with straight lines, sharp angles, and smooth curves.

.2 Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.

.3 Make permanent shop and field connections with continuous fillet type welds.

.4 Grind exposed welds smooth.

.5 Conceal fastenings where practicable.

.6 Shop fabricate in as large assemblies as practicable.

.7 Meet requirements specified under Structural Steel for fabricating items of structural nature or use.

.8 Qualify welding processes and welding operators in accord with AWS.

2.3 METAL FABRICATIONS

.1 General:

.1 Supply items required to complete construction and installation.

.2 Minimum Workmanship Standards: Fabricate true, straight and accurate to sizes indicated with joints closely fitted and properly secured

.3 Anchorage accessories:

.1 Items required to secure wood to metal, wood to masonry, metals to masonry or concrete, metal to metal or metal to other items.

.2 Metal Gratings:

.1 Complying with NAAMM Metal Bar Grating Manual.

.2 Material and Thickness (except were otherwise indicated):
.1 Galvanized steel, nominal 38 mm thick.
.3 Load Capacity: Support minimum uniform load of 10 kPa.
.4 Provide hold down clips.
.5 Serrated tops.
.6 Slip resistant tops.
.7 Furnish with frames and support items of comparable material and finish.

2.4 STEEL PIPE HANDRAILS AND GUARDRAILS

.1 Design and fabricate handrails, guardrails, railings and balusters to provide load capacity as required by BC Building Code 2018 and authorities having jurisdiction.

.2 General:
.1 Provide where indicated on the drawings.
.2 Provide members of type, style and profile indicated to provide steel handrails and guardrails in patterns indicated with minimum guardrail pipe diameter pipe 40 mm. Maximum handrail diameter 40 mm.

.3 Provide fully welded construction, using internal slip connectors. Grind joints flush and smooth so that joints are invisible after painting.

.4 Provide mitered joints at square turns.

.5 Provide smooth radiuses at bends and maintain uniform cross-section throughout with no kinks, buckling or twisting.

.6 Return ends to walls with fully concealed anchors, except where detailed not to return to wall.

.7 Provide brackets, flanges, fittings and anchors for connecting railing to railing and railing to floors, landings, stringers and walls.

.8 General:
.1 Provide galvanized steel.
.2 Minimum pipe diameter pipe 40 mm.

3. EXECUTION

3.1 INSPECTION

.1 Verify suitability of substrate to accept installation.

.2 Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

.1 General:
.1 Set work level, true to line, plumb.
.2 Shim and grout as necessary.

.3 Weld field connections and grind smooth.

.4 Where practical, conceal fastenings.

.5 Secure metal to wood with lag screws of adequate size with appropriate washers.

.6 Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.

.1 Use expansion bolts, toggle bolts, or screws for light duty service.

.7 Meet structural requirements for erecting items of structural nature.

.8 Do not field splice fabricated items unless size requires splicing.

.9 Weld splices.

.10 Provide fabricated items complete with attachment devices as required to install.

.2 Galvanic Repair:

.1 After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.

.2 Surface preparation: Remove contaminates.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Rough carpentry.
- .2 Roof trusses.
  - .1 Design per Drawings

.2 Related Specification Sections include but are not necessarily limited to:
- .1 Section 03 15 19 – Anchorage to Concrete

1.2 QUALITY ASSURANCE

.1 Referenced Standards:
- .1 The Engineered Wood Association (APA):
  - .1 PRP-108, Performance Standards and Qualification Policy for Structural Use Panels.
  - .2 U450, Storage and Handling of APA Trademarked Panels.
  - .3 Y510, Plywood Design Specification.
- .2 ASTM International (ASTM):
  - .1 A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .2 D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
  - .3 D4442, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
  - .4 D4444, Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters.
  - .5 E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .3 Canadian Wood Council
  - .1 CAN/CSA-080 Wood Preservation
- .4 American Wood Protection Association (AWPA):
  - .1 M2, Standard for Inspection of Preservative Treated for Industrial Use.
  - .2 M3, Standard for the Quality Control of Preservative Treated Products for Industrial Use.
  - .3 M4, Standard for the Care of Preservative-Treated Wood Products.
  - .4 T1 Processing and Treatment Standard.

.5 U1, Use Category System: User Specification for Treated Wood.

.5 FM Global (FM):

.1 1-49, Property Loss Prevention Data Sheets - Perimeter Flashing.

.6 Canadian Wood Council

.7 Underwriters Laboratories, Inc. (cUL):

.1 723, Standard for Test for Surface Burning Characteristics of Building Materials.

.2 Miscellaneous:

.1 Factory marking:

.1 Lumber:

.1 Identify type, grade, moisture content, inspection service, producing mill, and other qualities specified.

.2 Marking may be omitted, as allowed by the building code, if certificate of inspection is provided for each shipment.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions for all products specified.

1.4 DELIVERY AND STORAGE

.1 Delivery, storage and handling of untreated wood products:

.1 Lumber: As recommended by the grading agency indicated on the grade stamp.

.2 Plywood: APA U450.

.2 Delivery, storage, handling and disposal of treated wood products: AWPA M4.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 MATERIALS

.1 General:

.1 Lumber (for framing, blocking, nailers, furring, grounds and similar members):

.1 CSA O141-2023

.2 Species:

.1 Untreated material:

.1 For nominal sizes up to and including 2 x 4: Douglas Fir or Spruce/Pine/Fir.

.2 For nominal sizes up to 2 inches thick and wider than 4 inches: Douglas Fir.

.3 Grade:

.1 For nominal sizes up to and including 2 x 4: Standard and better.

.2 For nominal sizes up to 2 inches thick and wider than 4 inches: #2 and better.

.2 Structural plywood:

.1 CSA O141 Sheathing Grade Plywood

.2 Preservative Treated Material:

.1 Moisture content:

.1 Prior to treatment: 25%.

.2 Kiln-dry after treatment (KDAT), ASTM D4442 and ASTM D4444:

.1 Lumber: 19% maximum.

.2 Plywood: 18% maximum.

.2 Preservative:

.1 Waterborne: ACQ.

.3 Wherever practicable, material to be treated shall be manufactured in its final form prior to treatment.

.3 Fasteners and Anchors:

.1 Nails and screws:

.1 Dry, non-corrosive exposure: Hot dipped galvanized meeting ASTM A153 or Type 304 stainless steel.

.2 Wet, corrosive, marine, and/or below grade: Type 316 stainless steel.

.2 Adhesive anchors, expansion anchors, self-tapping concrete anchors, bolts, nuts, and washers:

3. EXECUTION

3.1 PREPARATION

.1 Verify measurements, dimensions, and shop drawing details before proceeding.

.2 Coordinate location of studs, nailers, blocking, grounds and similar supports for attached work.

.3 Eliminate sharp projections which would puncture roofing, flashing or underlayment material.

3.2 ERECTION AND INSTALLATION

.1 General:

.1 Provide preservative treated material for all wood used:

.1 Outside building.

.2 Below grade.

.2 Attach work securely by anchoring and fastening as indicated or required to support applied loading.

.1 Anchor wood to concrete using adhesive anchors

.1 Separate wood from direct contact to concrete with polyethylene foam gasket strip.

.1 Size: 1/4 inches by width of wood member.

.2 Owens Corning "SillSealR".

.2 Anchor wood to metal using bolts and nuts.

.3 Provide flat washers under all bolt heads and nuts.

.3 Set work to required levels and lines, plumb, true.

.1 Shim as required.

.2 Cut and fit accurately.

.4 Provide wood grounds, nailers, or blocking where required for attachment of other work and surface applied items.

.1 Install roofing nailers as necessary for attachment of flashing, curbs, fascia, coping, and related accessories:

.1 Match height of nailers to insulation.

.5 When wood has been exposed to moisture allow to completely dry out prior to covering with additional wood or another material.

.6 Correct or replace wood which shows bowing, warping or twisting to provide a straight, plumb and level substrate for applications of other materials.

.7 Exterior Wall Sheathing Installation:

.1 Install sheathing in accordance with manufacturer's installation guidelines and fastening requirements for loading requirements noted in the Contract Documents.

.2 Install sheathing with "gold side" out.

.3 Use maximum lengths possible.

.4 Do not tape joints between panels.

.5 If sheathing surface varies more than 1/8 inches from any one panel to an adjoining panel, remove the panels and reset.

.1 If the condition persists, remove the panels and correct sub framing as required so panels align properly.

.6 Drive fasteners to bear tight against and flush with surface of sheathing.

.1 Do not countersink, fracture core or puncture facers with head of fastener.

.8 Wood Trusses:

.1 Use care when handling so as not to subject trusses to excessive lateral bending.

.2 Erect trusses in accordance with recommendations of TPI HIB so as to be level, plumb and in correct location.

.3 Cutting and altering trusses is not permitted.

.4 Brace trusses sufficiently during construction to prevent toppling or dominoing prior to placing any load on trusses.

.5 Connect trusses to remainder of structure using wood connectors in accordance with details on drawings and manufacturers' recommendations.

.6 Provide bracing where required by truss designer.

END OF SECTION

SECTION 06 82 00
FIBERGLASS REINFORCED PLASTIC FABRICATIONS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Fiberglass reinforced plastic (FRP) fabrications including but not limited to:

.1 Grating.

.2 Structural members.

.3 Supporting structure design.

.2 Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American National Standards Institute (ANSI):

.1 A14.3, Safety Requirements for Fixed Ladders and Workplace Surfaces Package.

.2 ASTM International (ASTM):

.1 E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 Occupational Safety and Health Administration (OSHA):

.1 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

1.3 DEFINITIONS

.1 Skid-resistant:

.1 Manufacturer's standard applied abrasive grit coating.

.2 Abrasive coated tape is not acceptable.

.2 FRP: Fiberglass Reinforced Plastic.

1.4 SYSTEM DESCRIPTION

.1 All fiberglass reinforced plastic support systems shall be designed by a registered professional structural engineer licensed in the Province of British Columbia.

1.5 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Manufacturer's installation instructions.

.2 Manufacturer's recommendations on reinforcing field cut openings.

.2 Fabrication and/or layout drawings.

.1 Plan showing profile, location, section and details of each item including anchorage or support system(s).
.2 Locations and type of expansion joints.
.3 Materials of construction including shop applied coatings.
.4 Listing of all accessory items being provided indicating material, finish, etc.

.3 Certifications:
.1 Certification that all components and systems have been designed and fabricated to meet the loading requirements specified.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and handle each item to preclude damage.

.2 Store all items on skids above ground.
.1 Keep free of dirt and other foreign matter which will damage items or finish and protect from corrosion and UV exposure.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
.1 Grating and solid plate:
.1 American Grating.
.2 Enduro Composites.
.3 Fibergrate Composite Structures, Inc.
.4 Harsco Industrial IKG.
.5 International Grating Inc.
.6 Mona Composites.
.7 Seasafe, Inc.
.8 Strongwell Corporation.

.2 Structural shapes:
.1 American Grating.
.2 Enduro Composites.
.3 Fibergrate Composite Structures, Inc.
.4 Mona Composites.
.5 Strongwell Corporation.

2.2 MATERIALS

.1 Fiberglass Reinforced Plastic (FRP):
.1 Vinyl ester with fiberglass reinforcing.
.1 Type V.

.2 Fire retardant.
.1 Flame spread: ASTM E84, 25or less.
.3 Colour: Safety Yellow

.2 Fasteners, Clips, Saddles, and Miscellaneous Components:
.1 Fiberglass

.3 Adhesive: Recommended by manufacturer.

.4 Skid-resistant Surfacing: Manufacturer-applied abrasive grit coating.

2.3 FABRICATION

.1 General:
.1 Verify field conditions and dimensions prior to fabrication.
.2 Chemical resistance.
.1 System shall be capable of withstanding occasional contact withthe following chemicals:
.1 50% caustic soda at 25 DEGC.
.3 Preassemble items in shop to greatest extent possible.
.4 All components shall be treated with UV inhibitor.
.5 Drill or punch holes with smooth edges.

.2 Grating and Solid Plate Material:
.1 Design live load:
.1 4.8 kPa uniform live load.
.2 14 kPa concentrated load.
.3 Maximum deflection of l/300 of span under a superimposed live load.
.2 Minimum grating depth: 1-1/2 inches.
.3 Bar span: Maximum of 1-1/2 inches center to center.
.4 Walking surface: Manufacturer's standard applied abrasive grit coating.

.3 Embedded Grating Supports:
.1 Fiberglass.
.2 Size to suit depth of grating.
.3 Provide leg or strap for embedding and anchoring into concrete.
.4 Similar to Strongwell "Duradek Fiberglass Curb Angle."

.4 Structural Members:
.1 Provide structural members having the same resin composition as the item being supported.
.2 Factory fabricate with all required connection holes and holes for work of other trades.

3. EXECUTION

3.1 INSTALLATION

.1 Install products in accordance with manufacturer's instructions.

.2 Set work accurately in location, alignment and elevation, plumb, level, and true.

.1 Measure from established lines and levels.

.2 Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

.3 Tolerances:

.1 Maximum variation from plumb in vertical line: 1/8 inches in 3 feet.

.2 Maximum variation from level of horizontal line: 1/4 inches in 20 feet.

.3 Maximum variation from plan location: 1/4 inches in 20 feet.

.3 Attach grating to each end and intermediate support clip or saddle with bolts, nuts and washers.

.1 Maximum spacing: 2 feet on-center with minimum of two per side.

.2 Attach clips or saddles to bearing bars only.

.3 Reinforce all field cut openings in accordance with manufacturer's recommendations.

.4 File cut ends of all fiberglass to a 1/32 inches radius.

.5 Seal cut ends of all items with catalyzed resin as recommended by manufacturer.

.1 Provide same resin used in fabrication of item as a minimum.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

1. GENERAL

1.1 SUMMARY

.1 Furnish labour, materials, tools, equipment, and services for Thermal Insulation in accordance with provisions of Contract Documents.

.2 Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

.1 Division 01

.2 Section 03 30 00 Cast-In Place Concrete

.3 Section 04 22 00 Concrete Masonry Units (CMU)

.4 Section 06 10 00 Rough Carpentry

.5 Section 07 27 43 Vapor Resistive Air Barrier

.6 Section 07 84 00 Firestopping

.7 Section 09 29 00 Gypsum Board

1.3 REFERENCES

.1 British Columbia Building Code 2018 Edition.

.2 ASTM International (ASTM):

.1 ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.

.2 ASTM C303 Standard Test Method for Dimensions and Density of Preformed Block and Board type Thermal Insulation.

.3 ASTM C356 Standard Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat.

.4 ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.5 ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

.6 ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.7 ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.8 ASTM C739 Standard Specification for Cellulosic Fiber Loose Fill-Thermal Insulation.

.9 ASTM C947 Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam with Third-Point Loading).

.10 ASTM C1104-M Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.11 ASTM C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.12 ASTM C1728 Standard Specification for Flexible Aerogel Insulation.

.13 ASTM D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 deg C and 30 deg C with a Vitreous Silica Dilatometer.

.14 ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.15 ASTM D2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.16 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

.17 ASTM E96/E96M Standard Test Method for Water Vapor Transmission of Materials.

.18 ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.

.19 ASTM E136 Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 deg C

.20 ASTM E605/E605M Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

.3 National Fire Protection Association (NFPA:

.1 NFPA 268 Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source

.2 NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components

.4 Underwriters Laboratory of Canada (ULC):

.1 CAN/ULC S102 Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC S114 Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.3 CAN/ULC S134 Standard Method of Fire Test of Exterior Wall Assemblies.

.4 CAN/ULC S701.1 Standard for Thermal Insulation, Polystyrene Boards.

.5 CAN/ULC S702.1 Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specifications.

.6 CAN/ULC S704 Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

.7 CAN/ULC S770 Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.4 QUALITY ASSURANCE

.1 Surface-Burning Characteristics: As determined by testing identical products according to CAN/ULC S102 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 SUBMITTALS

.1 Product Data:

.1 Manufacturers' product data sheets, details and installation instructions including components and accessories, indicating product is in compliance with specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

.2 Protect foam-plastic board insulation as follows:

.1 Do not expose to sunlight except to necessary extent for period of installation and concealment.

.2 Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.

.3 Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Rigid Board Insulation Extruded Polystyrene (XPS):

.1 Base:

.1 Owens-Corning.

.2 Optional:

.1 DuPont.

.2 Mineral Fiber Insulation:

.1 Base:

.1 Rockwool

.2 Optional:

.1 Thermafibre Inc, an Owners Corning company.

.2 Johns Manville.

.3 Mechanical fasteners:

.1 Base:

.1 GEMCO.

.4 Adhesive for use with mechanical fasteners:

.1 Base:

.1 As approved by fastener manufacturer.

.5 Fiberglass Batt Insulation:

.1 Base:

.1 Owens-Corning.

.2 Optional:

.1 CertainTeed

.2 Johns Manville.

.3 Knauf Insulation.

.6 Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

.1 Rigid Board Insulation - Extruded Polystyrene Foam (XPS): Foundation Wall Board Insulation complies with CAN/ULC S701.1 with either natural skin or cut cell surfaces.

.1 Minimum Compressive Strength:

.1 Subgrade Applications: Refer to Structural for types and locations.

.2 Subgrade Applications

.1 100 PSI | 690 kPa. (type V).

.2 Minimum Surface Burning Characteristics per CAN/ULC S102 and NFPA 268:

.1 Flame Spread: Class A 25 or less.

.2 Flame Spread: 75 or less.

.3 Smoke Developed: less than 450.

.4 No ignition from radiant heat source.

.5 Complies with fire resistance requirements indicated on Drawings as part of an exterior non-load bearing exterior wall assembly when tested in accordance with CAN/ULC S134.

.3 Compressive Strength per ASTM D1621:

.1 100 PSI | 690 kPa, min.

.4 Water vapour permeance per ASTM E96:

.1 1.50 perm | 85.8 ng/s/m2/Pa, maximum.

.5 Water absorption per ASTM C272, D2842:

.1 0.3 PCT by volume, maximum.

.6 Thermal resistance per ASTM C518:

.1 R-value of 5.0 per inch at 75 degrees F mean temperature.

.2 RSI of 0.88 per 25 mm at 24 degrees C mean temperature.

.7 Base Product:

.1 Foamular Next Generation Extruded (NGX) by Owens Corning.

.8 Optional:

.1 Styrofoam™ Brand Cavitymate™ Ultra SL by Dow.

.9 Minimum thickness: 50 mm or as indicated on drawings.

.2 Mineral Fiber Insulation: Preformed rigid mineral fibre board insulation manufactured in accordance with CAN/ULC S702.1.

.1 Unfaced, non-combustible, water repellant, semi-rigid rock wool insulation board.

.2 Temperature Resistance: Per ASTM C612.

.1 Over 1093 degreesC.

.3 Combustibility and Surface Burning Characteristics: Rated non-combustible in accordance with CAN/ULC S114.

.4 Surface Burning Characteristics in accordance with CAN/ULC S114.

.1 Flame Spread: 0 to 25.

.2 Smoke Developed: 0 to 50.

.5 Moisture Resistance: Absorbs less 0.03 PCT by volume, per ASTM C1104.

.6 Thermal Resistance per ASTM C518 (C177): R-value 4.2 per inch | RSI 0.7 m2K/W per 25 mm.

.7 Monolithic Density: 4.3 PCF | >69 kg/m3.

.8 Dual Density: 6.2 PCF | 100 kg/m3.

.9 Non-corrosive per ASTM C665.

.10 Thickness: As noted in drawings.

.11 Base: ROCKWOOL Cavityrock dual density.

.12 Optional: Thermafiber RainBarrier 45.

.13 Mechanical fasteners; impaling clips/pins:

.1 Pronged hangers and slotted washers or arrow pointed hangers.

.2 Size pins to fit insulation thickness.

.3 Base Product: GEMCO as manufactured by Goodloe E. Moore.

.1 Gemco pronged hanger with pronged washer.

.4 Optional:

.1 Midwest Fasteners.

.14 Mastic for use with mechanical fasteners:

.1 Base Product: As approved by fastener manufacturer.

.3 Mineral Wool Batt Insulation.

.1 Non-combustible, lightweight, semi-rigid mineral wool batt insulation complying with CAN/ULC S-702.1, Type 1; friction fit; unfaced flame spread index of 0

.2 Fire Performance:

.1 Non-Combustible in accordance with CAN/ULC S114.

.2 Surface Burning Characteristics: when tested in accordance with CAN/ULC S102:

.1 Flame Spread: 0

.2 Smoke Developed: 0

.3 Thermal Resistance of 0.67 to ASTM C518.

.4 Density: 2.0 PCF | 32 kg/cubic meter.

.5 Recycled Content: 40 PCT.

.6 Size: 600 x 1200 mm | 24 inch x 48 inch.

.7 Thickness: As indicated on drawings.

.8 R Value: Nominal R-13 unless indicated otherwise.

.9 Base Product: Rockwool ComfortBatt.

.4 Cavity Firestop:

.1 FirePro by Rockwool Inc.

.1 1 HR Fire Barrier where indicated on drawings.

.2 Provide for horizontal and vertical applications as required, including all accessories, retaining clips, metal wire, etc. to complete firestop assembly.

3. EXECUTION

3.1 INSPECTION

.1 Verify suitability of substrate to accept installation.

.2 Installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION

.1 General:

.1 Insulate full thickness over surfaces to be insulated.

.2 Fit tightly around obstructions, fill voids.

.3 Cover penetrations with insulation.

.4 Comply with manufacturer's instructions for installation unless more stringent requirements are specified.

.5 Consult manufacturer's technical representative if installation instructions are not applicable.

.6 Apply rigid insulation over 50 mm thickness in double layer with staggered joints to achieve total thickness.

.7 Do not use broken or torn pieces of insulation.

.2 Rigid Fiber Insulation in Rain Screen and Cavity Wall construction:

.1 Verify vapour retarder and moisture barrier installation is complete.

.2 Comply with manufacturer's directions for particular conditions of installation.

.3 Secure insulation by use of mechanical fasteners; impaling clips and pins.

.1 Locate fasteners 150 mm from edges and at 300 mm OC each direction.
.2 Lay out work before installing mechanical fasteners.
.3 Lay out fasteners and install in mastic.
.4 Allow mastic to set.
.5 Test to ensure fasteners are secure.
.6 Install washers

.4 Extend insulation full thickness over entire surface to be installed.
.5 Cut and fit tightly around penetrating elements and abutting construction.
.6 Install rigid fiber insulation with tight joints, without voids, pressing onto mechanical fasteners.
.7 Do not install insulation over or within 75 mm of recessed lighting fixtures, ballasts, wiring compartments, fans, or other heat-generating devices unless fixtures are protected.

.3 Rigid Board Insulation (XPS) at foundations:
.1 Extend down for distance indicated in one layer.
.1 If not indicated, extend down to design frost line.
.2 Install in mastic with tight joints on walls.
.3 Protect from damage and/or displacement during backfilling.
.4 Apply Concrete Faced Insulation Panel to exterior, exposed portions of foundation.
.1 Install with concealed fasteners. Where exposed fasteners must be used, cover fastener head with sealant.
.2 Seal exposed insulation with manufacturer's standard trim.
.3 Seal joints between panels with concrete masonry sealant.
.4 Miter outside corners and seal joint.

.4 Rigid Board Insulation (XPS) under foundations:
.1 Place as noted on structural drawings
.2 Protect from damage and/or displacement during backfilling.
.3 Tape joints

END OF SECTION

SECTION 07 26 00
UNDER SLAB VAPOR RETARDER

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Under slab vapour retarder.

.2 Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Concrete Institute (ACI):

.1 302.2R, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

.2 ASTM International (ASTM):

.1 E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

.2 E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Product data sheet on vapour retarder sheet and vapour retarder tape.

.2 All accessories proposed for use.

.3 Manufacturer's installation instructions.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Vapor retarder:

.1 Fortifiber Building Systems Group, Inc. by Henry Company.

.2 Layfield Group, Ltd.

.3 ISI Building Products.

.4 Raven Industries, Inc.

.5 Reef Industries, Inc.

.6 Stego Industries, LLC.

.7 W.R. Meadows, Inc.

2.2 PERFORMANCE REQUIREMENTS

.1 Vapour Retarder:

.1 ASTM E1745, Class A.

.2 Thickness: Minimum 15 mil.

.3 Water vapor permeance: 0.02 maximum.

2.3 ACCESSORIES

.1 Pipe Boots: Manufacturer's standard boot fabricated to maintain the integrity of the vapour retarder system.

.2 Vapour Retarder Tape: As recommended by vapor retarder manufacturers.

3. EXECUTION

3.1 PREPARATION

.1 Base material over which vapor retarder is to be installed shall be level, compacted and free of debris, foreign objects or other deleterious materials.

.2 Surfaces at perimeter and penetrations of vapor barrier shall be clean, smooth and free of sharp objects, fins or projections.

3.2 INSTALLATION

.1 Install products in accordance with manufacturer's instructions, ASTM E1643 and ACI 302.2R.

.2 Provide vapor retarder where indicated on the Drawings.

.1 Place continuous vapor retarder above granular fill subgrade material, unless noted otherwise.

.3 Lap minimum 6 inches and seal in accordance with ASTM E1643 and manufacturer's recommendations.

.4 Extend to extremities of area and seal to adjacent elements.

.5 Seal all penetrations: Provide pipe boot for all pipes or conduit penetrating the floor slab.

3.3 FIELD QUALITY CONTROL

.1 Ensure proper precautions are implemented to prevent damage to installed vapor retarder membrane prior to and during pouring of concrete floor slab.

.2 Inspect vapour retarder immediately prior to placement of concrete.

.1 Patch all punctures, tears, holes, etc.

.1 Patch small punctures with vapor retarder tape as allowed by ASTM E1643 and manufacturer's recommendations.

.2 Repair larger damage with additional layer of vapor retarder.

.1 Lap repairs minimum 6 inches beyond extent of damage in all directions.

.2 Seal perimeter of patch with vapor retarder tape or as recommended by manufacturer.

END OF SECTION

SECTION 07 27 43
VAPOUR RESISTIVE AIR BARRIER

1. GENERAL

1.1 SUMMARY

.1 Furnish labour, materials, tools, equipment, and services for Vapour Resistive Air Barrier, as indicated, in accordance with provisions of Contract Documents.

.2 Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

.1 Manufacturer Qualifications:

.1 Air and vapour barrier systems shall be manufactured by firm with minimum of 20 years of experience in production of waterproofing.

.2 Obtain primary air barrier materials and air barrier accessories from single source from single manufacturer.

.2 Installer Qualifications:

.1 Minimum five years of continued experience in successful installation of vapour and water resistive air barrier products on similar project applications.

.3 ASTM International (ASTM):

.1 ASTM E96 Test Methods for Water Vapor Transmission of Materials.

.2 ASTM E2178 Test Methods for Air Permeance of Building Materials.

.3 ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

.4 ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

.5 ASTM D1876 Test Method for Peel Resistance of Adhesives.

.6 ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

.4 International Code Council Evaluation Service, Inc.: ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.

.5 National Fire Protection Association (NFPA):

.1 NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.3 SUBMITTALS

.1 Product Data:

.1 Manufacturer’s literature indicating specified material and required components.

.2 Project Information:

.1 Written documentation of applicator's qualifications.

.3 Contract Closeout Information:

.1 Installer Warranty.

1.4 WARRANTY

.1 Installer five-year warranty for air and vapour barrier and accessories have been installed in accordance with manufacturer's recommendations, and that components used in this section have been sourced from one manufacturer.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Vapor Resistive Air Barrier:

.1 Base:

.1 Soprema

.2 Optional:

.1 Henry Company

.2 Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

.1 General:

.1 Air barrier capable of performing as a continuous, vapour retarding air barrier. Design system to accommodate substrate movement and to seal to substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

.2 Air Permeance:

.1 Maximum 0.0011 L/s-m^2 as tested in accordance with ASTM E2178.

.3 Vapour Permeance:

.1 Maximum 4.6 ng/Pa-s-m^2 when tested in accordance with ASTM E96.

.4 Exposure Rating:

.1 Provide material with appropriate exposure rating to suit construction schedule.

.5 Application Window:

.1 Provide summer or winter grade wall membrane based upon ambient weather conditions at time of installation.

.2 Verify specialty product meets design criteria of standard product.

.3 Submit for approval.

2.3 MATERIALS

.1 Self-adhesive membrane:

.1 40 mil rubberized asphalt bonded to composite aluminum and polyethylene film facer.

.2 Base Product:
  .1 Soprema Stick 1100T.
.3 Optional Products:
  .1 Henry Blueskin SA.

.2 Transition Membrane:
  .1 Self-adhesive.
  .2 Compatible with air barrier and adjacent substrate.
  .3 As recommended by air barrier manufacturer.

.3 Termination Mastic:
  .1 Rubberized asphalt-based mastic.
  .2 Bituthene Mastic.
  .3 Manufacturer's recommended termination for non-asphaltic products.

.4 Primer:
  .1 Surface preparation primer required per manufacture's installation requirement.
    .1 Soprema Stick Primer
    .2 Henry Blueskin Adhesive

3. EXECUTION

3.1 PREPARATION

.1 Examine conditions for compliance with requirements for installation, tolerances and other specific conditions affecting performance of air barrier.

.2 Substrate to be smooth and free of voids, spalled areas and sharp protrusions.

.3 Masonry Substrates:
  .1 Fill voids, holes and mortar joints, with lean mortar mix, non-shrinking grout or parge coat.
  .2 Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
  .3 Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
  .4 Strike masonry joints smooth and completely fill with mortar.

.4 Remove deleterious materials from surfaces to be covered.

.5 Do not proceed with installation until unsatisfactory conditions have been corrected.

.6 Installation indicates acceptance of substrates and responsibility for performance.

3.2 INSTALLATION

.1 Install according to manufacturer's instructions.

.2 Perform work only when existing and forecast weather conditions are within limits established by manufacturer.

.3 Join air barrier in an airtight and flexible manner to air barrier material of adjacent systems, allowing relative movement of systems due to thermal and moisture variations and creep between:

.1 Foundation and walls.

.2 Walls or doors.

.3 Wall and roof over unconditioned space.

.4

.5 Walls to utility, pipe and duct penetrations.

.4 Air and Vapour Barrier Membrane:

.1 Primer: Apply at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.

.2 Sheet Membranes:

.1 Apply membrane horizontally or vertically and press firmly into place with hand roller.

.2 Start at the bottom of vertical surfaces and work up.

.3 Do not reverse shingle membranes or detail tape.

.4 Stagger end lap seams.

.5 Transition Membrane:

.1 Install mastic at terminations, substrate transitions, penetrations and overlaps according to manufacturer's standard details.

.2 Overlap fluid applied membrane onto each surface at beams, columns and joints.

.3 Tie in to window and door frames, spandrel panels, roof and floor intersections, and changes in substrate.

.4 Seal top edge of flashing with termination mastic.

3.3 PROTECTION

.1 Schedule work to ensure that system is covered as soon as practicable.

.1 Protect system from damage during subsequent operations.

.2 Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer.

.1 Apply temporary UV protection if system cannot be covered within prescribed period.

.2 Replace air barrier if determined be damaged by UV exposure by Manufacturer.

.3 Replace air barrier exposed to UV for longer than recommended period.

.3 Clean spills, stains, and soiling from construction that would be exposed in completed work as recommended by manufacturer of affected construction.

.4 Remove masking materials after installation.

END OF SECTION

SECTION 07 27 46
VAPOUR PERMEABLE AIR BARRIER

1. GENERAL

1.1 SUMMARY

.1 Furnish labour, materials, tools, equipment, and services for Vapor Permeable Air Barrier, as indicated, in accordance with provisions of Contract Documents.

.2 Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

.1 Division 01

.2 03 30 00 Cast-In Place Concrete

.3 07 21 00 Thermal Insulation

1.3 REFERENCES

.1 British Columbia Building Code 2018.

.2 Underwriters Laboratories of Canada (CAN/ULC):

.1 CAN/ULC S741 Standard for Air Barrier Materials Specifications.

.2 CAN/ULC S742 Standard for Air Barrier Assemblies Specifications.

.3 ASTM International (ASTM):

.1 ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

.2 ASTM D1876 Test Method for Peel Resistance of Adhesives.

.3 ASTM E96-M16 Test Methods for Water Vapor Transmission of Materials.

.4 ASTM E2178 Standard Test Method for Air Permeance of Building Materials.

.5 ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

.6 ASTM E783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

.7 ASTM E1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.8 ASTM E1186 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications:

.1 Air and vapour barrier systems shall be manufactured by firm with minimum of 20 years of experience in production of waterproofing.

.2 Obtain primary air barrier materials and air barrier accessories from single source from single manufacturer.

.2 Installer Qualifications:

.1 Accredited Contractor by National Air Barrier Association (NABA).

.2 Certified Installer by National Air Barrier Association present for preparation and installation.

.3 Minimum five years of continued experience in successful installation of vapor and water resistive air barrier products on similar project applications.

.3 International Code Council Evaluation Service, Inc.: ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.

.4 National Fire Protection Association (NFPA):

.1 NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

.5 Preinstallation Conference:

.1 See Section 01 31 19.

1.5 SUBMITTALS

.1 Shop Drawings:

.1 Show locations and extent of air barrier.

.2 Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

.2 Product Data:

.1 Manufacturer’s literature indicating specified material and required components.

.3 Project Information:

.1 Written documentation demonstrating applicator’s qualifications.

.2 Minutes of Preinstallation Conference.

.3 Mockup and Field Test:

.1 See Field Quality Control for description and test requirements.

.2 Coordinate with Owner’s inspection and testing agency.

.3 Do not cover installed work before inspection, testing and approval.

.4 Submit Field Test Reports upon completion.

.5 Mock-up may remain as part of the work.

.4 Contract Closeout Information:

.1 Installer Warranty.

1.6 WARRANTY

.1 Installer five year warranty for air and vapor barrier and accessories have been installed in accordance with manufacturer's recommendations, and that components used in this section have been sourced from one manufacturer.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Vapour Permeable Air Barrier:

.1 Base:

.1 Henry Company.

.2 Optional:

.1 Carlisle Coatings and Waterproofing.

.2 GCP Applied Technologies

.2 Integrated Vapor Permeable Air Barrier:

.1 Base:

.1 US Gypsum.

.2 Optional:

.1 Georgia-Pacific Gypsum.

.3 Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

.1 General:

.1 Air barrier capable of performing as a continuous, vapor permeable air barrier. Design system to accommodate substrate movement and to seal to substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

.2 Air Permeance:

.1 Maximum allowable 0.02 L/(s*m2) @ 75 Pa water pressure differential, as tested in accordance with ASTM E2178.

.3 Vapor Permeance:

.1 Minimum 10 Perms when tested in accordance with ASTM E96.

.4 Exposure Rating:

.1 Provide material with appropriate exposure rating to suit construction schedule.

.2 Membrane designed to withstand long term UV exposure without affecting performance.

.5 Application Window:

.1 Provide standard or low temperature air barrier based upon ambient weather conditions at time of installation.

.2 Low temperature product shall meet or exceed design criteria of standard product.

2.3 MATERIALS

.1 Self-adhesive air barrier membrane:
- .1 Microporous sheet membrane with factory applied adhesive.
- .2 Base Product:
  - .1 Blueskin VP160 by Henry.
- .3 Optional Products:
  - .1 Fire Resist 705 VP by Carlisle.
  - .2 Perm-A-Barrier VPS by Grace.

.2 Fluid applied air barrier membrane:
- .1 35 dry MIL elastomeric membrane.
- .2 Base Product:
  - .1 Henry Air Bloc 17MR.
  - .2 Henry All-Weather STPE.
- .3 Optional Product:
  - .1 Carlisle Fire Resist Barritech VP.
  - .2 GCP Perm-A-Barrier VPL.

.3 Transition Membrane:
- .1 Self-adhesive.
- .2 Compatible with air barrier and adjacent substrate.
- .3 As recommended by air barrier manufacturer.

.4 Primer: Spray applied adhesive as directed by manufacturer for substrate.

.5 Termination Sealant:
- .1 Silicone sealant as recommended by air barrier manufacturer.

3. EXECUTION

3.1 PREPARATION

.1 Examine conditions for compliance with requirements for installation, tolerances and other specific conditions affecting performance of air barrier.

.2 Substrate to be smooth and free of voids, spalled areas and sharp protrusions.

.3 Masonry Substrates:
- .1 Fill voids, holes and mortar joints, with lean mortar mix, non-shrinking grout or parge coat.
- .2 Verify that concrete has cured and aged for minimum time recommended by air barrier manufacturer.

.3 Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

.4 Strike masonry joints smooth and completely fill with mortar.

.4 Exterior Sheathing Panels:

.1 Pre-treat joints with reinforced self-adhesive tape or mesh style wallboard tape.

.2 Caulk gaps greater than 6 mm | 1/4 IN.

.5 Remove deleterious materials from surfaces to be covered.

.6 Do not proceed with installation until unsatisfactory conditions have been corrected.

.7 Installation indicates acceptance of substrates and responsibility for performance.

3.2 INSTALLATION

.1 Install according to manufacturer's directions.

.2 Perform work only when existing and forecast weather conditions are within limits established by manufacturer.

.3 Join air barrier in an airtight and flexible manner to air barrier material of adjacent systems, allowing for relative movement of systems due to thermal and moisture variations and creep, between:

.1 Foundation and walls.

.2 Walls and windows or doors.

.3 Different wall systems.

.4 Wall and roof.

.5 Wall and roof over unconditioned space.

.6 Walls, floors and roof across construction, control and expansion joints.

.7 Walls, floors and roof to utility, pipe and duct penetrations.

.4 Air and Vapor Barrier Membrane:

.1 Primer: Apply at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.

.2 Sheet Membranes:

.1 Apply membrane horizontally or vertically and press firmly into place with hand roller.

.2 Start at the bottom of vertical surfaces and work up.

.3 Do not reverse shingle membranes or detail tape.

.4 Stagger end lap seams.

.5 Apply membranes horizontally to primed CMU along the underside line of masonry anchors, beginning at base of wall. Overlap sheet below 50 mm | 2 IN minimum.

.6 Backnail membrane alongside lap prior to installing next sheet of membrane at soffits, ceilings or oriented strand board (OSB).

.3 Fluid Applied Membranes:

.1 Spray or trowel apply continuous uniform film using multiple, overlapping passes to ensure even thickness and coverage.

.2 Carry membrane into openings minimum 75 mm | 3 IN.

.3 Seal brick ties and penetrations as work progresses.

.5 Transition Membrane:

.1 Install mastic at terminations, substrate transitions, penetrations and overlaps according to manufacturer's standard details.

.2 Overlap fluid applied membrane onto each surface at beams, columns, and joints.

.3 Tie into window and door frames, spandrel panels, roof and floor intersections, and changes in substrate.

.4 Seal top edge of flashing with termination mastic.

.6 Flexible Membrane Through Wall Flashing:

.1 Fully adhere flashing to substrate.

.2 Overlap adjacent pieces and roll seams.

.3 Trim bottom edge 12 mm | 1/2 IN back from exposed face of wall.

.4 Turn up ends minimum of 50 mm | 2 IN at heads, sills and flashing terminations. Fold to form an end dam and seal seams.

.5 Seal top edge of flashing with termination mastic.

3.3 FIELD QUALITY CONTROL

.1 Mockup:

.1 Construct typical exterior wall section, incorporating back-up wall, cladding, window, door frame and sill, insulation, flashing and other critical junctions.

.2 Allow adequate time to inspect and test mock-up before proceeding with work.

.3 Mock-up shall be tested for air and water infiltration in accordance with ASTM E1186, ASTM E783, and ASTM E1105.

.1 If deficiencies are found, reconstruct mock-up until satisfactory test results are obtained.

.2 Implement improved installation procedures for completing balance of Air Barrier.

.4 Mock-up may be part of the work.

.2 Quality Assurance Program:

.1 Enlist project in National Air Barrier Association NABA Quality Assurance Program.

.2 Include cost of program in bid.

.3 Air barrier materials and installation are subject to inspection and may include following:

.1 Testing to be performed determined by Owner's testing agency for compliance with requirements.

.2 Where test results do not meet requirements: Correct deficiencies, retest, and implement improved installation procedures for completing balance of Air Barrier.

3.4 PROTECTION

.1 Schedule work to ensure that system is covered as soon as practicable.

.1 Protect system from damage during subsequent operations.

.2 Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer.

.1 Apply temporary UV protection if system cannot be covered within prescribed period.

.2 Replace air barrier if determined be damaged by UV exposure by Manufacturer.

.3 Replace air barrier exposed to UV for longer than recommended period.

.3 Clean spills, stains, and soiling from construction that would be exposed in completed work as recommended by manufacturer of affected construction.

.4 Remove masking materials after installation.

END OF SECTION

SECTION 07 42 03

THERMAL ISOLATION MOUNTING SYSTEM

1. GENERAL

1.1 SECTION INCLUDES

.1 ISO Clip - Thermal Isolation Clip. 3.25 inch

.2 Clip mounting fasteners

.3 Sub-Girts

1.2 RELATED SECTIONS

.1 Section 03 15 19 – Anchorage

.2 Section 07210 - Thermal Insulation.

.3 Section 06100 - Rough Carpentry.

1.3 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM):

.1 ASTM A792 - Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 National Fire Protection Association (NFPA):

.4 NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

.5 National Energy Code for Buildings (NECB):

.1 NECB SB-10 – Supplementary Standard.

.6 Underwriters Laboratories Canada (ULC):

.1 CAN/ULC-S134-13 - Standard Method of Fire Test of Exterior Wall Assemblies. (Note conducted on both combustible and non-combustible cladding.)

1.4 SUBMITTALS

.1 Submit under provisions of Section 01300 - Administrative Requirements.

.2 Product Data:

.1 Manufacturer's data sheets on each product to be used.

.2 Preparation instructions and recommendations.

.3 Storage and handling requirements and recommendations.

.4 Typical installation methods.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

.2 Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

.3 Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

.4 Provide subgirt and clip engineered to support dead, live, and lateral, wind or seismic, loads indicated.

.1 Provide design by a Professional Engineer registered in the Province of British Columbia.

.2 Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Store and handle in strict compliance with manufacturer's written instructions and recommendations.

.2 Protect from damage due to weather, excessive temperature, and construction operations.

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 recommended limits.

1.8 WARRANTY

.1 Manufacturer’s standard limited warranty unless indicated otherwise.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable Manufacturer: Northern Facades ISO clip

.2 Requests for substitutions will be considered in accordance with provisions of Section 01600 – Product Requirements.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

.1 Product: 3.25 inch (83 mm) ISO Clip - Thermal Isolation Clip: Assists in creating thermal break between interior and exterior of building. Reduces thermal transfer through building envelope.

.1 Standards Compliance:

.1 ASHRAE 90.1, NECB, SB-10 compliance, with thermal analysis available.

.2 NFPA 285: Pass.

.3 CAN / ULC S134-13: Pass.

.2 Clip Material: 14ga ASTM A792 Galvalume or ASTM A653 Galvanized, steel.

.3 Thermal Isolator Pad: Glass fibre reinforced polyamide.

.4 Adjustment: Plus or minus 1/2 inch (13 mm) wall deviation. No shims required.

.5 Insulation Thickness Range: 4 to 6 inch (101 to 152 mm) of insulation.

.2 Contractor to coordinate with cladding manufacturer and engineer to confirm loading conditions.

2.3 SUBGIRT

.1 Subgirt to be compatible with thermal isolation clip as confirmed by the clip manufacturer.

.2 Material

.1 Galvanized G90 or Galvalume

.2 16-Gauge min

.3 Vertical orientation

.4 24” c/c maximum

.5 Length: as required

3. EXECUTION

.1 EXAMINATION

.1 Do not begin installation until substrates have been properly constructed and prepared.

.2 If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

.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.

3.2 INSTALLATION

.1 Install cladding support system components in accordance with manufacturer's written instructions, approved submittals, and the following:

.1 Install in proper relationship with adjacent materials.

.2 Install cladding support system assembly level, plumb, and square within 1/8 inch in 20 ft. (3.2 mm in 6.1 m) noncumulative allowable tolerance.

.2 Install cladding support system in compliance with orientation, sizes, and locations as indicated.

.1 Use termination trim at rough openings to properly transition and enclose continuous insulation (CI) system to provide thermally broken transition from opaque wall assemblies.

.2 Trim to be covered by exterior cladding materials and flashings.

3.3 FIELD QUALITY CONTROL

.1 Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

3.4 CLEANING AND PROTECTION

.1 Clean products in accordance with the manufacturer's recommendations.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 42 16
PREFORMED METAL PANELS

1. GENERAL

1.1 SUMMARY

.1 Furnish labour, materials, tools, equipment, and services for Preformed Metal Panels, as indicated, in accordance with provisions of Contract Documents.

.2 Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

.1 Installer Qualifications:

.1 Installer franchised or approved in writing by manufacturer.

.2 ASTM International (ASTM):

.1 ASTM A653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM A755 Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

.3 ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus

.4 ASTM B209 Specification for Aluminum and Aluminum Alloy Sheet and Plate

.5 ASTM C645 Specification for Nonstructural Steel Framing Members

.6 ASTM C754 Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products

.7 ASTM C920 Specification for Elastomeric Joint Sealants

.8 ASTM C1363 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

.9 ASTM D968 Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

.10 ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

.11 ASTM E84 Test Methods for Surface Burning Characteristics of Building Materials

.12 ASTM E119 Test Methods for Fire Tests of Building Construction and Materials

.13 ASTM E1996 Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

.3 American Architectural Manufacturer's Association (AAMA):

.1 AAMA 501.1 Standard Test Method for Exterior Windows, Curtain Walls, and Doors for Water Penetration Using Dynamic Pressure

.2 AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

.3 AAMA 508-07 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems

.4 AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

.5 AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

.4 American Society of Civil Engineers (ASCE):

.1 ASCE 7 Minimum Design Loads for Buildings and Other Structures.

.5 National Fire Protection Association (NFPA):

.1 NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

.2 NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

.6 Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):

.1 Architectural Sheet Metal Manual.

.7 UL:

.1 UL 263 Fire Resistance Tests of Building Construction and Materials.

.2 UL 723 Test for Surface Burning Characteristics of Building Materials.

.3 UL 1040 Fire Test of Insulated Wall Construction.

.4 UL 1715 Room Corner Test.

.8 Provide Preformed Metal Panels engineered to support dead, live, and lateral, wind or seismic, loads indicated.

.1 Provide design by a Professional Engineer registered in the Province of British Columbia.

.2 Include headers and reinforcing members around openings.

.3 Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.3 SUBMITTALS

.1 Product Data:

.1 For each type of material and accessory.

.2 Shop Drawings:

.1 Elevations showing each metal panel and attachment point.

.2 Details of each condition of installation and attachment.

.3 Details of each transition and termination.

.3 Contract Closeout Information:

.1 Warranty.

1.4 WARRANTY

.1 Provide five year warranty on wall panels, flashing and associated work.

.2 Warranty to cover waterproof integrity of panel system against leaks through wall.

.3 Warranty signed by Contractor and Installer.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Preformed Metal Panels:

.1 Base:

.1 Vicwest.

.2 Optional:

.1 Petersen Aluminum.

.2 Firestone Una-Clad.

.2 Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

.1 Design Loads:

.1 Design Preformed Metal Panels and anchorage to meet design loads shown on the drawings.

.1 Wind Loads:

.1 As noted on Structural Drawings

.2 950 Pa minimum.

.2 Deflection Values: Use the most restrictive of the following:

.1 Limit deflection to values specified for Uniform Design Load Test.

.2 Limit deflection to comply with Building Code as locally adopted and amended.

.3 Limit deflection to L/175 or 19 mm maximum.

.2 Thermal Expansion and Structural Movement:

.1 Expansion and contraction, caused by changes in surface temperature equal to DT (delta T).

.1 Delta T for this project: 90 deg C.

.2 Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.

.3 Operating windows and doors shall function normally over this temperature range.

.3 Drainage:

.1 Design Preformed Metal Panels to intercept, collect, contain, and drain water which may infiltrate system to exterior.

2.3 MATERIALS

.1 Preformed Metal Panels:

.1 Steel sheets: Z275 coated per ASTM A653.

.2 Concealed fasteners.

.3 20 gauge

.4 Joints factory caulked or gasketed.

.2 Profile:

.1 Base: AD200 Series by Vicwest.

.2 Exterior finish:

.1 WeatherXL

.2 Colour as selected.

.3 Perimeter Trim, Flashing and Accessories:

.1 As required to complete entire wall panel installation.

.2 Shop fabricated corners.

.3 Match gage, colour, and finish of wall panels.

.4 Fastening System as approved by Manufacturer to meet Design Criteria.

3. EXECUTION

3.1 EXAMINATION

.1 Verify suitability of substrate to receive installation.

.2 Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

.1 Erect system, per reviewed shop drawings.

.2 Erect with concealed fasteners.

.3 Use fasteners which lock entire unit to structural supports and prohibit negative load pull-off under design loads.

3.3 FIELD TESTING

.1 Upon completion of walls, perform field water test in accordance with AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

.2 Spray entire surface of exterior walls.

.3 Repair leaks.

3.4 PROTECTION

.1 Provide required temporary closures and flashings to maintain weather integrity, during and after erection.

END OF SECTION

SECTION 07 46 46

FIBER CEMENT SIDING

1. GENERAL

1.1 SECTION INCLUDES

.1 Fiber cement lap siding, panels, shingle, trim, fascia, moulding and accessories; James Hardie HZ10 Engineered for Climate Siding.

.2 Factory-finished fiber cement lap siding, panels, shingle, trim, fascia, moulding and accessories; James Hardie HZ10 Engineered for Climate Siding.

1.2 RELATED SECTIONS

.1 Section 03 15 19 – Anchorage

.2 Section 07 21 00 - Insulation: Exterior wall insulation.

1.3 REFERENCES

.1 ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.

.2 ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 SUBMITTALS

.1 Submit under provisions of Section 01 33 00.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:

.3 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.

.4 Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications: Minimum of 2 years experience with installation of similar products.

.2 Provide siding engineered to support dead, live, and lateral, wind or seismic, loads indicated.

.1 Provide design by a Professional Engineer registered in the Province of British Columbia.

.2 Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

.2 Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

.3 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

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 HZ10 lap siding for 30 years.

.2 HardiPanel HZ10 vertical siding for 30 years.

.3 HardieSoffit HZ10 panels for 30 years.

.4 HardieShingle HZ10 siding for 30 years.

.5 HardieTrim HZ10 boards for 15 years.

.6 Artisan HZ10 lap siding for 30 years.

.7 Artisan HZ10 Lock Joint System siding for 30 years

.2 Finish Warranty: Limited product warranty against manufacturing finish defects.

.3 When used for its intended purpose, properly installed and maintained according to 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.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable Manufacturer: James Hardie Building Products, Inc.

.2 Requests for approval of equal substitutions will be considered in accordance with provisions of Section 01 25 00.

2.2 SIDING

.1 General:

.1 Fabricate to pattern indicated on Drawings.

.2 System shall be designed for loading noted on the drawings and the building code.

.2 Vertical Siding: HardiePanel HZ10 siding as manufactured by James Hardie Building Products, Inc.

.1 Type: Cedarmill Vertical siding panel 4 feet by 10 feet (1219 mm by 3048 mm).

.3 Soffit Panels: HardieSoffit HZ10 soffit panel, factory sealed on 5 sides as manufactured by James Hardie Building Products, Inc.

.1 Type: Smooth vented, provides 5 square inches (32.3 sq.cm) of net free ventilation per linear foot, 12 inches (305 mm) by 12 feet (3658 mm).

.2 Type: Smooth vented, provides 5 square inches (32.3 sq.cm) of net free ventilation per linear foot, 16 inches (406 mm) by 12 feet (3658 mm),

.3 Thickness: 1/4 inch (6 mm).

.4 Trim:

.1 HardieTrim HZ10 boards as manufactured by James Hardie Building Products, Inc.

.2 Product: Batten Boards, 2-1/2 inch (63 mm) width.

.3 Product: 4/4 Boards, 7-1/4 inch (184 mm) width.

.1 Texture: Wood Grained.

.4 Length: 12 feet (3658 mm).

.5 Thickness: 3/4 inch (19 mm).

.6 Thickness: 1 inch (24 mm).

.7 HardieTrim HZ10 Fascia boards as manufactured by James Hardie Building Products, Inc.

.5 Intermediate Support Items:

.1 Steel, galvanized, G90 coating.

.2 Minimum 16 GA.

.3 Intermediate (Subgirts) to comply with 03 15 19 Anchorage

2.3 FASTENERS

.1 Metal Framing:

.1 As required by anchorage engineer.

2.4 FINISHES

.1 Factory Primer: Provide factory applied universal primer.

.1 Primer: Factory primed by James Hardie

.2 Factory Finish: Refer to Exterior Finish Schedule.

.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 photo spectrometer and verified by third party.

.3 Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed

.4 Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer.

.3 Factory Finish Colour for Trim, Soffit and Siding Colours:

.1 Selected by Owner from Standard Colours

3. EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If framing preparation is the responsibility of another installer, notify Owner 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.

3.3 INSTALLATION - HARDIEPANEL VERTICAL SIDING

.1 Install materials in strict accordance with manufacturer's installation instructions.

.2 Place fasteners no closer than 3/8 inch (9.5 mm) from panel edges and 2 inches (51 mm) from panel corners.

.3 Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

.4 Maintain clearance between siding and adjacent finished grade.

.5 Specific framing and fastener requirements refer to. ICC-ES Evaluation Report No. ESR-1844

.6 Factory Finish Touch Up: Apply touch up paint to cut edges in accordance with manufacturer's printed instructions.

.1 Touch-up nicks, scrapes, and nail heads in pre-finished siding using the manufacturer's touch-up kit pen.

.2 Touch-up of nails shall be performed after application, but before plastic protection wrap is removed to prevent spotting of touch-up finish.

.3 Use touch-up paint sparingly. If large areas require touch-up, replace the damaged area with new pre-finished siding. Match touch up color to siding color through use of manufacturer's branded touch-up kits.

3.4 INSTALLATION - HARDIETRIM HZ10 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.

END OF SECTION

SECTION 07 61 13
STANDING SEAM METAL ROOFING

1. GENERAL

1.1 SUMMARY

.1 Furnish labour, materials, tools, equipment, and services for Standing Seam Metal Roofing, as indicated, in accordance with provisions of Contract Documents.

.2 Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

.1 Division 1

.2 Section 07 21 00 Thermal Insulation

.3 Section 07 62 00 Sheet Metal Flashing and Trim

1.3 REFERENCE STANDARADS

.1 British Columbia Building Code 2018.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers.

.3 ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.4 ASTM E1637 Standard Specification for Structural Standing Seam Aluminum Roof Panel Systems.

.5 ASTM E1646 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

.6 ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

.3 Underwriters Laboratories (UL):

.1 UL 580 - Test for Wind-Uplift Resistance of Roof Assemblies.

.1 UL 263 – Fire Tests of Building Construction and Materials.

.2 UL 790 - Test for Fire Resistance of Roof Covering Materials.

.3 UL-2218 - Impact Resistance Test.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications:

.1 Company engaged in copper or other unpainted metal roofing work with three years' experience in similar size and type of installations.

.2 Architectural roofing fabricated in a permanent stationary indoor facility.

.2 Installer Qualifications:

.1 Minimum of two (2) years' experience in installation of concealed clip architectural standing seam metal roofing and show evidence of successful completion of at least 3 projects of similar size, scope, and complexity.

.2 An entity that employs installers and supervisors who are trained or approved by manufacturer.

.3 British Columbia Roofing Contractors Association

.3 American Welding Society (AWS):

.1 AWS Sheet Steel in Structures, Specification for Welding AWS D1.3.

1.5 SUBMITTALS

.1 Product Data:

.1 For each type of material and accessory.

.2 Samples:

.1 Colour samples of finishes.

.3 Project Information:

.1 Certification of conformance with wind uplift standard listed.

.4 Contract Closeout Information:

.1 Warranty.

1.6 WARRANTY

.1 General Warranty:

.1 Provide fifteen (15) year RCABC warranty for water tightness of roof and associated flashing signed by roofing installer.

.2 Warrant water tightness of roof and associated flashing.

.2 PVDF Finish:

.1 Provide twenty (20) year warranty against fading, chalking, cracking or failure resulting in corrosion.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Standing Seam Metal Roofing:

.1 Base:

.1 Vicwest.

.2 Optional:

.1 Petersen Aluminum.

.2 Firestone Una-Clad.

.2 Underlayment:

.1 Base:

.1 Same as Metal Roof Manufacturer.

.2 Optional:

.1 Approved by Metal Roof Manufacturer.

.3 Galvanizing repair paint:

.1 Base:

.1 Tnemec.

.2 Optional:

.1 ZRC Worldwide.

.4 Snow Guards:

.1 Base:

.1 Snow Management Systems.

.5 Other manufacturers desiring approval comply with Division 1.

2.2 DESIGN CRITERIA

.1 Static Air Infiltration:

.1 Maximum infiltration: 0.007 CFM/SQ FT | 0.00003556 m3/s per m2 at a pressure differential of 6.24 PSF 298 Pa when tested in accordance with ASTM E1680.

.2 Static Water Infiltration:

.1 No uncontrollable water leakage at a pressure differential of 6.24 PSF | 298 Pa when tested in accordance with ASTM E1646.

.3 Design Roof System to resist

.1 Snow Loads and snow build-up and rain load, expected in this geographical region BCBC climatic data, 50 year probability, corrected to site elevation | 9.8 KPa.

.2 Wind loads, positive and negative, expected in this geographical region BCBC climatic data, 50 year probability | 0.32 KPa; Roof uplift 1.2 KPa

2.3 MATERIALS

.1 Factory-formed, pre-finished, batten style panel system with concealed fasteners over solid substrate.

.2 Fabricate trim and flashings from same material as roof system material.

.3 Painted Steel Panels:

.1 Sheet Steel: ASTM A653, Grade-A.

.2 Galvanized Coating: ASTM A653, G90 Z275 zinc coating.

.3 Base Product: Vicwest Prestige .

.1 Batten Panels.
.1 Batten Caps: Matching with positive locking mechanism.
.4 Minimum Sheet Thickness:
.1 Steel: 24 GA | 0.6 mm.
.5 Spacing of Standing Seams:
.1 16 IN | 400 mm.
.6 Finish:
.1 Exposed:
.1 Signature Finish System
.2 Colour:
.1 To be selected by Owner from manufacturer's standard line |Charcoal 56072
.7 Metal roofing clips and fasteners:
.1 ASTM A653, Z180 G60 galvanized sheet steel.
.2 Minimum 26 GA | 0.55 mm before coating.
.3 Configurations and sizes required by Manufacturer.

.4 Underlayment:
.1 Cold-applied, self-adhering rubberized asphalt membrane with cross laminated polyethylene film.
.1 Minimum sheet thickness: 40 MIL | 1 mm.
.2 Vapour Permeance: less than 0.05 perms | 2.86 ng/s/m2/Pa.
.3 Tensile Strength: 250 PSI | 1.7 MPa.
.4 Rated for use from -29 DEGC to 121 DEGC.
.5 Primer as required for substrate.
.2 Base Product:
.1 Vicwest ClimaGUARD.
.3 Optional:
.1 Other products approved by Roof Manufacturer for warranty.

.5 Fasteners:
.1 Nails:
.1 Large head galvanized roofing nails.
.2 Screws:
.1 Stitch Teks, 12-14 x 3/4 hex washer head with pilot point.
.2 Colour to match roofing.

.6 Snow Guards:
.1 Base Product: SMS Snow Clamp by Snow Management System.

.7 Roof Sheathing:

.1 Specified in Section 06 10 53.

.1 Minimum 5/8 IN | 16 mm thick combination preservative and fire treated exterior grade wood and plywood.

.2 Non-fire rated assemblies:

.1 Minimum 5/8 IN | 16 mm thick preservative treated, exterior grade wood and plywood.

.8 Insulation:

.1 Specified in Section 07 21 00.

3. EXECUTION

3.1 INSPECTION

.1 Inspect entire area to be roofed for acceptability.

.2 Correct unsatisfactory conditions.

.3 Commencement of roofing activities constitutes acceptance of conditions affecting installation and responsibility for roofing system performance.

3.2 INSTALLATION

.1 Do not start placement of roofing until supporting members are installed complete.

.2 Install metal roofing panels to profiles, patterns and drainage indicated and required for leak-proof installation.

.3 Provide for structural and thermal movement.

.4 Prevent galvanic action of dissimilar metals.

.5 Conceal fasteners where possible in exposed work.

.6 Form joints to conceal sealant.

.7 Deck Reinforcement:

.1 Reinforce openings between 150 and 300 mm with 0.9 mm steel sheet 300 mm greater in each dimension than opening.

.2 Place sheet around opening and weld to top surface of deck at each corner and each side midway between each corner.

.8 Underlayment:

.1 Install membrane directly on clean, dry, continuous structural deck in accordance with manufacturers recommendations.

.2 Place first coarse starting at the eave.

.3 Overlap subsequent layers.

.4 Install additional layers of underlayment at ridges, valleys, penetrations, equipment curbs, adjoining walls and similar conditions.

.9 Metal Roofing:

.1 Install cleats as required.

.2 Place each panel on supporting structural frame, adjust to final position, and accurately align with ends bearing on supporting members.

.1 Install panels in one continuous length.

.2 Lap units at ends minimum 50 mm and stagger horizontal joints.

.3 Do not stretch or contract side lap interlocks.

.4 Place panels flat and square and secure to framing without warp or excessive deflection.

.3 Remove and replace panels which are structurally weak, unsound or have burn holes scratches or other damage caused by shipping or installation.

.4 Form trim with flush, telescoped, or nested 50 mm end and side laps.

.5 Cut and fit panels and accessories around other work projecting through or adjacent to roofing.

.1 Make cutting and fitting neat, square and trim.

.2 Neatly and accurately reinforce openings exceeding 150 mm in diameter or on a side.

.6 Install metal closure strips as required.

.1 Provide where rib openings in top surface of roof decking occur adjacent to edge and openings.

.2 Form tight-fitting closures at open ends and sides.

.3 Securely fasten closure strips into position.

.10 Snow Guards:

.1 Locate snow guard arrays as indicated on Drawings.

.2 Locate snow guard as recommended by manufacturer.

.3 Mechanical Attachment:

.1 As per manufacturer's recommendations.

3.3 CLEANING AND PROTECTION

.1 Cleaning:

.1 Remove temporary coverings and protection of adjacent work areas.

.2 Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

.2 Touch Up:

.1 Retouch scarred areas, welds and rust spots.

.3 Protect installed product from damage during construction.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

1. GENERAL

1.1 SUMMARY

.1 Furnish labour, materials, tools, equipment, and services for Flashing and Sheet Metal, as indicated, in accordance with provisions of Contract Documents.

.2 Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

.1 Division 1

.2 Section 06 10 00 Rough Carpentry

.3 Section 07 61 13 Standing Seam Metal Roofing

.4

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.2 ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate.

.4 ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

.5 ASTM B308/B308M Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.

.6 ASTM F2329/F2329M Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

.2 British Columbia Building Code 2018 .

1.4 QUALITY ASSURANCE

.1 Roofing Contractors Association of British Columbia (RCABC).

.2 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

.1 Architectural Sheet Metal Manual.

.3 Product Source: Provide sheet metal flashing & trim which are produced by one manufacturer. Provide accessory materials (fasteners, clips, etc.) which are compatible to the zinc manufacturer.

.4 Field Measurements: Prior to fabrication of sheet metal flashing & trim, compare architectural drawings, approved shop drawings, and actual field measurements of substrates to receive sheet metal flashing & trim. Make necessary minor adjustments to satisfy design intent and functional performance. Notify Construction Manager / Consultant of any major discrepancies to structure and substrate that deviate from the original intent of the Architect.

.5 Soldering: In accordance with instructions provided by manufacturer.

1.5 DESIGN REQUIREMENTS

.1 Install sheet metal flashing and trim including underlayment materials with positive laps to avoid trapping of water. Flashing to divert all moisture infiltration to the building exterior.

.2 Wind Load: As required by local code and contract documents, design and engineer sheet metal flashing and trim, including size, spacing, and quality of mechanical fasteners and clips, to meet requirements established by engineering calculations and local building codes.

.3 Thermal Movement: Provide profiles and detail connections which allow for thermal movement of metal resulting from ambient temperature range of 49 degrees C. Individual flashing and trim profiles shall have fixing point as needed to allow thermal movement of profiles.

.4 Structural Performance: Provide flashing, trim, anchors, and attachments which resist loads as required by code and as documented in engineering requirements without permanent deflection or deformation.

1.6 SUBMITTALS

.1 Shop Drawings:

.1 Dimensioned drawings of profiles and shapes.

.2 Plans and elevations to show locations of each shape.

.2 Samples:

.1 For finish, colour, and colour range selection.

.3 Contract Closeout Information:

.1 Warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Protect materials from damage.

.2 Rolled Zinc to be transported according to manufacturer’s recommendations.

.3 Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

.4 Prevent contact with materials which may cause dis-colouration or staining.

.5 Sequence deliveries to avoid delay and minimize on-site storage.

1.8 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of Substantial.

.2 Warranty: Include coverage to correct defective work and for failure to meet specified requirements.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Formed Sheet Metal items:

.1 Base:

.1 Vicwest.

.2 Optional:

.1 Cascadia.

.2 Petersen Aluminum, PAC-CLAD.

.3 Other manufacturers desiring approval comply with Section 01 25 13.

2.2 MATERIALS

.1 Sheet Metal – Galvanized Steel with PVDF coating.

.1 ASTM A653/A653M galvanized steel, Z275 G90.

.2 Minimum thickness:

0.6 mm 24 gauge. As noted for individual fabrications.

.3 Smooth.

.4 Textured.

.5 PVDF coating: Minimum 0.025 mm fluorocarbon coating, 70 PCT PVDF.

2.3 SHEET METAL FABRICATIONS

.1 Formed Roof Edge Flashing, Gravel Stop and Fascia Coping:

.1 Fabricate to size and profile indicated.

.2 Supply sections with minimum length of 2440 mm, but not exceeding 3 m.

.3 Joint Style:

.1 Single Overlap, 100 mm wide

.2 6 mm Butt Joint with 150 mm wide, exposed cover plate.

.3 6 mm Butt Joint with 300 mm wide, concealed backup plate

.2 Hanging Gutters:

.1 Fabricate to size and profile indicated, complete with end pieces, outlet tubes, and other accessories as required.

.1 Gutters shall be complete with mitered corners, end caps, and outlets sized to fit downspouts.

.2 Material:

Hanging Gutters - Minimum Sheet Thickness / Weight				
Material	Gutter Girth			
	up to 20 IN up to 520 mm	21 to 25 IN 521 to 650 mm	26 to 30 IN 651 to 770 mm	31 to 35 IN 771 to 890 mm
PVDF coated Galvanized Steel	0.024 IN 0.61 mm	0.034 IN 0.864 mm	0.040 IN 1.016 mm	0.052 IN 1.132 mm
PVDF coated Galvanized Steel	0.040 IN 1.016 mm	0.050 IN 1.27 mm	0.063 IN 1.6 mm	-
PVDF coated Galvanized Steel	0.019 IN 0.483 mm	0.025 IN 0.635 mm	0.031 IN 0.787 mm	0.038 IN 0.965 mm

.3 Fabricate sections in maximum lengths practical; not less than 2440 mm long.

.4 Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice gutter thickness.

.5 Fabricate expansion joints, expansion joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

.6 Gutter supports shall be adjustable minimum 25 mm wide by minimum 2 mm thick hanger, provided in sufficient number to be located at maximum 30 IN 760 mm on center, or minimum 0.81 mm thick continuous cleats.

.7 Expansion joint options are based on SMACNA designations and illustrations. Butt type with cover plate hides the expansion joint on front and bottom sides.

.8 Expansion Joints: Lap or Butt types.

.9 Expansion Joints: Butt type with cover plate on front and bottom sides.

.10 Accessories:

.1 Continuous removable leaf screen with sheet metal frame and hardware cloth screen.

.2 Wire ball downspout strainer.

.3 Valley baffles.

.3 Downspouts:

.1 Fabricate downspouts to size and profile indicated in minimum 3 m lengths with section ends formed for minimum 12 m telescoped and locked joints with formed or mitered elbows.

.2 Match material and thickness to gutter material.

.3 Shape: Rectangular.

.4 Shape: Round.

.5 Shape: Rectangular with open face.

.6 Furnish with metal hangers, from same material as downspouts, and anchors.

.7 Provide wire ball strainers for gutter outlets, elbows and offsets.

.8 Downspout supports:

.1 Minimum 1 mm thick clips.

.2 Minimum 3 mm thick anchors.

.3 Minimum 1.5 mm thick by 50 mm wide leader straps or rack and pin type fasteners.

.1 Provide a minimum 25 mm clearance between downspout and building wall.

.2 Locate at maximum 1.5 m on center.

.3 Use SMACNA standard detail appropriate for downspout.

.4 Wall Closures and Trim.

.1 Fabricate to shapes and profiles indicated and as required to close gaps between wall panels, and transitions to adjacent assemblies.

.2 PVDF Coating: 70 PCT PVDF in Colour to match panels or as selected by Consultant.

.5 Through-Wall Flashings.

.1 Shapes and profiles to suit application and as indicated on drawings.

.2 Protect concealed surfaces against galvanic action and corrosion from contact with other materials.

.3 Exposed surfaces shall have 70 PCT PVDF coating in colour selected by Consultant.

.4 Fabricate drip edges to promote positive drainage and resist effects of surface tension.

2.4 ACCESSORIES

.1 Fasteners:

.1 Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by flashing manufacturer.

.2 Blind fasteners or self drilling screws, gasketed, with hex-washer head.

.3 Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.

.4 Blind Fasteners: High strength aluminum or stainless steel rivets suitable for metal being fastened.

.5 Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

.6 Fastener Materials:

.1 Fasteners for Galvanized Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329/F2320M.

.2 Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

.3 Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

.2 Cleats:

.1 1.6 mm galvanized or stainless steel.

.3 Dissimilar metal and cementitious materials protection:

.1 Alkali resistant bituminous paint.

.2 Tnemec Tneme Tar 46-413.

.4 Base Flashing:

.1 Fabricate to size and profile indicated.

.5 Counterflashing and Flashing Reglets:

.1 Fabricate to size and profile indicated.

.2 Provide interior and exterior preformed corners as required.

.3 Fabricate as required to fit special conditions.

2.5 FABRICATION

.1 General:

.1 Fabricate true and sharp to profiles and sizes indicated.

.2 Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA Architectural Sheet Metal Manual, that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated.

.3 Shop fabricate items to greatest extent possible.

.4 Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

.5 Form sheet metal flashing and trim without oil canning, buckling, and tool marks, true to line and level indicated, with exposed edges folded back to form hems.

.6 Conceal fasteners and expansion provisions where possible. Exposed fasteners not allowed on faces exposed to view.

.2 Fabrication Tolerances:

.1 Fabricate sheet metal flashing and trim to tolerance of 6 mm per 6 m on slope and location lines as indicated and within 3 mm offset of adjoining faces and alignment of matching profiles.

.3 Sealed Joints: Form movable joints in metal to accommodate elastomeric sealant.

.4 Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep. Fill with butyl sealant concealed within joints.

.5 Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

.6 Fabricate cleats and attachment devices of sizes as recommended by SMACNA Architectural Sheet Metal Manual for application, but not less than thickness of metal being secured.

.7 Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

.8 Seams in metals with painted, coated, or lacquered finishes:

.1 Fabricate nonmoving seams with flat-lock seams.

.2 Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

.3 Rivet joints where necessary for strength.

.9 Do not use graphite pencils to mark metal surfaces.

3. EXECUTION

3.1 INSPECTION AND PREPARATION

.1 Installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION - GENERAL

.1 Install in accordance with details and recommendations of SMACNA, current edition.

.2 Provide miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.

3.3 INSTALLATION – GUTTERS AND DOWNSPOUTS

.1 Install gutters below slope line of roof, supported on adjustable hangers spaced maximum 760 mm on center or by continuous cleats.

.2 Join gutter sections with flat locked, riveted and sealed joints with hard setting sealant fill.

.3 Adjust gutters to slope uniformly to downspout outlets, with high point midway between outlets.

.4 Install downspouts supported by leader straps or concealed rack and pin type fasteners at top, bottom and intermediate points not exceeding 1.5 m on center.

.5 Install downspout 25 mm clear of building wall.

3.4 CLEAN-UP

.1 Upon completion of work, repair damaged areas.

.2 Repair finish of PVDF coated flashing which fades or is damaged.

.3 Clean stains and debris.

.4 Remove protective coverings.

END OF SECTION

SECTION 07 72 33
ROOF HATCHES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Roof hatches.

.2

.2 Related Specification Sections include but are not necessarily limited to:

.1 Section 07 62 00 - Flashing and Sheet Metal.

.2 Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 ASTM International (ASTM):

.1 B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Manufacturer's installation instructions.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

.3 Informational Submittals:

.1 Warranty.

1.4 WARRANTY

.1 Roof Hatches: Manufacturer's standard five year warranty.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Products specified are manufactured by "The Bilco Company."

.2 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Roof hatches:

.1 The BILCO Company.

.2 Maxam Metal Products

2.2 MATERIALS

.1 Sheet Metal:

.1 Aluminum: ASTM B209.

.2 Insulation:

.1 Curb: 3 inch polyisocyanurate.

.2 Cover: 3 inch polyisocyanurate .

.3 Gaskets: Extruded EPDM rubber.

.4 Hardware: Type 316 stainless steel, unless noted otherwise.

.5 Anchors:

.1 Stainless steel.

.2 See Specification Section 03 15 19.

2.3 MANUFACTURED UNITS

.1 General:

.1 12 inches high.

.2 Fully welded corners.

.3 Hardware:

.1 Lifting mechanism and automatic hold-open device.

.2 Hinges.

.3 Latch: Operating handles for inside and outside operation.

.4 Padlock hasp.

.4 Finish: Mill.

.2 Roof Hatches:

.1 Curb:

.1 11 GA.

.2 Integral cap flashing.

.3 Mounting flange:

.1 Minimum 3-1/2 inches wide.

.2 Punched holes for fastening to roof deck.

.4 Insulated.

.2 Cover:

.1 Exterior: 11 GA.

.2 Interior: 11 GA liner.

.3 Internally reinforced.

.1 Minimum 40 psf live loading.

.4 Insulated.

.5 Completely weather sealed and gasketed.

.3 Finish: Mill.

3. EXECUTION

3.1 INSTALLATION

.1 Install units in accordance with manufacturer's installation instructions.

.2 Securely anchor units as appropriate.

.1 Anchor to wood nailers with 1/2 x 3 inches lag bolts.

.2 Anchor to concrete with 1/2 inches adhesive anchors.

.3 Anchor to steel with 1/2 inches stainless steel bolts, nuts and washers.

.4 Maximum anchor spacing: 12 inches.

.5 Manufacturer's predrilled fastener locations take precedent over this specification.

.6 Provide attachment at each corner as a minimum.

.3 Flash and counterflash to provide weathertight installation.

.1 See Specification Section 07 61 1300 for roofing.

.4 Adjust all components to provide smooth easy operation.

.5 Provide dissimilar metals protection as required.

.1 Refer to Specification Section 09 96 00.

3.2 SCHEDULE

.1 Model numbers refer to "Maxam Metals " products.

.2 Schedule:

ROOF HATCH NO.	DRAWING NO.	LOCATION	MODEL NO.	REMARKS
RH-101	A004	Pump One	THB-R20-48x48	
RH-201	A004	Pump Two	THB-R20-48x48	

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

1. GENERAL

1.1 SUMMARY

.1 Furnish labour, materials, tools, equipment, and services for Firestopping, in accordance with provisions of Contract Documents.

.2 System Description:

.1 Through Penetration Firestop Systems for protection of penetrations through following fire resistance rated assemblies, including both blank openings and openings containing penetrating items:

.1 Roof assemblies.

.2 Floor assemblies.

.3 Roof-ceiling assemblies.

.4 Wall and partition assemblies.

.5 Fire rated smoke barrier assemblies.

.2 Fire Resistive Joint Assemblies for linear voids where fire rated floor, roof, or wall assemblies abut one another, including following types of joints:

.1 Top and bottom of wall interface with overhead roof or floor structure:

.1 Select products to maintain acoustical, smoke and fire ratings indicated.

.3 Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

.1 Division 01

.2 Section 03 30 00 Cast-in-Place Concrete

.3 Section 04 22 00 Concrete Unit Masonry

1.3 REFERENCES AND STANDARDS

.1 British Columbia Building Code 2018.

.2 FCIA – Firestop Contractors International Association.

.3 FM 4991 – Factory Mutual, Approval Standard for Firestop Contractors.

.4 IAS AC291 – Accreditation Criteria for Special Inspection Agencies.

.5 IFC EJ Guidelines – Recommended International Firestop Council (IFC) Guidelines for Evaluating Firestop System Engineering Judgments.

.6 ULC (DIR) – Online Certifications Directory (Canada).

.7 ULC Current Edition:

.1 CAN/ULC S101 – Standard Methos of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC S115 – Standard Method of Fire Tests of Firestop Systems.

.3 CAN/ULC S702.1 – Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

.4 UL 2079, Tests for Fire Resistance of Building Joint Systems

.8 UL/ULC Fire Resistance Directory:

.1 Through Penetration Firestop Systems (XHEZ).

.2 Joint Systems (XHBN).

.3 Fill, Void or Cavity Materials (XHHW).

.4 Firestop Devices (XHJI).

.5 Forming Materials (XHKU).

.6 Wall Opening Protective Materials (CLIV).

.7 Fire Resistance Ratings (BXRH)

.9 ASTM International (ASTM):

.1 ASTM C847 Standard Specifications for Metal Lath.

.2 UL 1479

.3 ASTM E2174 Standard Practice for On-site Inspection of Installed Fire Stops.

.4 ASTM E2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA).

.5 ASTM E2393 Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.6 ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.10 National Fire Protection Association (NFPA):

.1 NFPA 70: National Electrical Code.

.2 NFPA 101: Life Safety Code.

.3 NFPA 221: Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls.

.4 NFPA 251: Fire Tests of Building Construction and Materials.

.11 Firestop Contractors International Association (FCIA):

.1 MOP – FCIA Firestop Manual of Practice

.12 International Firestop Council (IFC):

.1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments, latest revision.

.2 Inspectors Field Pocket Guide, latest edition.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications:

- .1 Certified, licensed or approved by firestopping manufacturer, trained to install firestop products per specified requirements.
- .2 Licensed by Provincial or local authority, where applicable.
- .3 Shown to have successfully completed not less than 5 comparable scale projects.
- .4 FM Approved in accordance with FM Standard 4991 – Approval of Firestop Contractors.
- .5 UL/ULC Qualified Firestop Contractor.
- .6 FCIA Contractor Member in good standing.

.2 Inspection Agency Qualifications: Independent firm specializing in performing testing and inspections of types specified in this section.

- .1 IAS AC291 Accredited for Firestop System.

.3 Identification Labels for Firestop Assemblies:

- .1 Follow guidelines set in Chapter 7 of International Building Code.
- .2 Coordinate with Section 04 22 00 and Section 09 29 00.

.4 Pipe insulation shall not be removed, cut away or otherwise interrupted at wall penetrations or floor openings.

- .1 Provide products appropriately tested for the thickness and type of insulation utilized.

.5 Cabling where frequent cable moves, additions, and changes are likely to occur in future:

- .1 Where cable trays are used:
  - .1 Utilize re-enterable products (e.g., removable intumescent blocks) specifically designed for retrofit.
- .2 Where cable trays are not used:
  - .1 Utilize fire rated cable pathway devices.
  - .2 Where not practical, re-enterable products designed for retrofit may be used.

.6 Protect penetrations passing through fire resistance rated floor-to-ceiling assemblies contained within chase wall assemblies with products tested by being fully exposed to fire outside of chase wall.

- .1 Identify systems within ULC Fire Resistance Directory with the words: Chase Wall Optional.

.7 Fire-resistive Joint Sealant:

- .1 Provide flexible fire resistive joint sealants to accommodate normal and thermal building movement without seal damage.
- .2 Provide fire resistive joint sealants designed to accommodate a specific range of movement.

.1 Test in accordance with cyclic movement test criteria as outlined in: ASTM E1399, ASTM E1966 or UL 2079.

.3 Provide fire resistive joint systems subjected to an air leakage test.

.1 Conduct in accordance with UL 2079, with published L-Ratings for ambient and elevated temperatures.

.8 Subject smoke barrier containment systems to air leakage test.

.1 Conduct in accordance with UL 1479, with published L-Ratings for ambient and elevated temperatures.

1.5 SUBMITTALS

.1 Product Data:

.1 Manufacturer's standard information indicating certification of products proposed for use on project.

.2 Project Information:

.1 UL/ULC schedule, listing type of penetration, joint condition, fire rating of assembly with illustration of systems, system design numbers, temperature ratings, and products proposed for use on project.

.2 Include floor plan showing locations of firestopping assemblies.

.3 Include certified UL/ULC system Designs, or approved substitute systems, for each condition.

.4 Contractor Certification per FM 4991, UL/ULC, HAFSC, or all.

.5 Certification as UL/ULC Qualified Firestop Contractor.

.6 Installer Qualifications: Company specializing in performing the work of this section and certification as list in QA above.

.7 Inspection Agencies Qualifications

.3 Contract Closeout Information:

.1 Provide electronic PDF file of firestop documentation to include following:

.1 Firestop affidavit.

.2 Firestop systems.

.3 Firestop system photograph of each type.

.4 Installation log.

.5 IFC guidelines for Engineering Judgments.

.6 Building Code sections relevant to firestop systems.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver firestopping products to Project site in original, unopened containers or package with intact and legible manufacturers' labels identifying product and manufacturer.

.2 Store and handle firestopping materials in accordance with manufacturer's instructions.

1.7 SITE CONDIITONS

.1 Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during and for three days after installation of materials.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Firestopping:

.1 Base:

.1 Hilti Inc.

.2 Optional:

.1 3M.

.2 Passive Fire Protecion Partners.

.3 Specified Technologies, Inc.

.4 Tremco, Inc.

.5 Canadian Gypsum Company.

.2 Forming Materials:

.1 Base:

.1 Hilti Inc.

.2 Optional:

.1 Rockwool.

.2 Thermafiber, Inc.

.3 Fire Rated Enclosures:

.1 Base:

.1 Tenmat, Inc.

.2 Optional:

.1 EZ Barrier, Inc.

.4 Other manufacturers desiring approval comply with Section 01 61 00.

.1 See systems Volume 2 of UL/ULC Building Materials Directory.

2.2 DESIGN CRITERIA

.1 Penetrations: Provide firestop systems that resist the spread of fire and the passage of smoke and other gases according to requirements indicated including, but not limited to the following:

.1 Firestop penetrations passing through fire-resistance-rated wall and floor assemblies and other locations as indicated on drawings.

.2 Provide and install complete penetration firestopping systems that have been tested and approved by a nationally recognized third-party testing agency.

.3 F- Rated Through-Penetration Firestop Systems: Provide through-penetrtion firestop systems with F and H ratings indicated, in accordance with:

.1 CAN/ULC S115, but not less thatn one hour or the fire-resistnace rating of the construction being penetrated.

.4 T-Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings, in addition to F ratings, in accordance with CAN/ULC S115, where indicated.

.5 L-Rated Through-Penetration Firestop Systems: Provide firestop systems with L ratings, in addition to F and T ratings, in accordance with CAN/ULC S115, where indicated.

.6 W-Rated Through-Penetration Firestop Systems: Provide firestop systems with W Water Resistance ratings, in addition to F, T and L ratings, in accordance with CAN/ULC S115, where indicated.

.2 Perimeter Fire Containment Systems: Provide interior perimeter fire containment systems with fire-resistance ratings indicated, when tested in accordance with ASTM E2307, but not less than the fire-resistance rating of the floor construction.

.3 Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, in accordance with CAN/ULC S115, but not less than the fire-resistance rating of the construction in which the joint occurs.

.4 Firestopping exposed to view, traffic, moisture, and physical damage: Provide firestop system designs for these conditions with Flame Spread Rating (FSR) of less than 25 and Smoke Developed Classification (SDC) of less than 50 in accordance with CAN/ULC S102.

.5 VOC: Use material s that comply with local VOC Regulations.

.6 Provide firestop systems in compliance with following requirements:

.1 Obtain firestop system for each type of penetration and construction condition from a single firestop systems manufacturer.

.2 Firestop products and systems shall bear classification marking of qualified testing and inspection agency.

.3 Firestopping tests, performed by qualified, testing and inspection agency.

.1 UL/ULC or other agency, performing testing and follow up inspection services for firestop systems, acceptable to local authorities having jurisdiction.

.4 Mold Resistance:

.1 Less than 1 per ASTM G21.

2.3 MATERIALS

.1 Through Penetration Firestop Systems:

.1 VOC content not to exceed 250 g/L.

.2 Base Products:

.1 FS-ONE MAX Intumescent Firestop Sealant.

.2 CFS-S SIL GG Elastomeric Firestop Sealant.
.3 CFS-S SIL SL Elastomeric Firestop Sealant.
.4 CP 620 Fire Foam.
.5 CP 606 Flexible Firestop Sealant.

.2 Fire resistive Joints:
.1 VOC content not to exceed 250 g/L
.2 Base Products:
.1 CFS-SP WB Firestop Joint Spray.
.2 CFS-S SIL GG Elastomeric Firestop Sealant.
.3 CFS-S SIL SL Elastomeric Firestop Sealant.
.4 CP 606 Flexible Firestop Sealant.
.3 Coordinate with pre-applied firestopping in Section 09 22 16.

.3 Intumescent Joints:
.1 For use at top of wall as firestop, smoke seal and sound seal.
.2 Comply with UL 2079 current edition.
.3 Base Products:
.1 CFS-TTS Firestop Top Track Seal by Hilti
.2 Speedflex by Specified Technologies, Inc.

.4 Firestop Devices:
.1 Factory assembled collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
.2 Base Products:
.1 CP 680-P Cast-in-Place Firestop Device.
.2 CP 680-M Cast-in-Place Firestop Device.
.3 CP 681 Tub Box Kit.
.4 CFS-DID Firestop Device.
.5 FCW-44 Firestop Cable Way.

.5 Intumescent Pads, Wall Opening Protective Materials:
.1 Intumescent, non-curing pads or inserts for protection of electrical panels, switch and receptacle boxes, medical gas outlets and valve boxes and other items recessed in face of fire rated walls.
.2 Base Product:
.1 CFS-P PA Firestop Putty Pad.
.2 CP 617 Firestop Putty Pad.
.3 Hilti Biox Insert.

.6 Fire Rated Cable Pathways:

.1 Steel raceway and intumescent pads with adjustable smoke seal sleeve.

.2 Fire rating equal to rating of barrier device penetrates.

.3 Pathway devices:

.1 Allow 0 to 100 percent fill of cables.

.2 Adjust automatically to cable additions or subtractions.

.4 Size to accommodate quantity and size of electrical wires and data cables indicated plus 100 percent expansion.

.5 Provide cable management devices with gang plates for single or multiple devices.

.6 Base products:

.1 CP 653 BA Speed Sleeve.

.2 CFS-SL GP Gangplate.

.3 CFS-SL GP CAP Gangplate Cap.

.4 CFS-CC Firestop Cable Collar.

.5 CFS-SL SK Firestop Sleeve.

.6 CFS-SL RK Retrofit Sleeve.

.7 CFS-COS Composite Sheet.

.7 Smoke and Acoustic Cable Pathways:

.1 Non-rated steel raceway with adjustable smoke seal polyurethane sleeve for single cables and cable bundles.

.2 Re-penetrable and self-closing.

.3 Base product:

.1 CS-SL SA Smoke and Acoustic Sleeve.

.8 Single Cable and Cable Bundles to 1 IN Diameter:

.1 CFS-D Firestop Cable Disc.

.9 Firestop Putty:

.1 Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers, or silicone compounds.

.2 Provide firestop putty at, but not limited to, the gap between wire, cabling, or both, exiting an open end of conduit, where conduit penetrates one or both sides of a smoke or fire rated wall assembly.

.3 Base products:

.1 CP 618 Firestop Putty Stick.

.2 CFS-PL Firestop Plug.

.10 Wrap Strips:

.1 Single component intumescent elastomeric strips faced on both sides with a plastic film:

.2 Base Products:

.1 CP 643N Firestop Collar.
.2 CP 644 Firestop Collar.
.3 CP 648E/648S Wrap Strips.

.11 Firestop Blocks and Plugs:
.1 Non-curing, flexible intumescent device.
.2 Re-enterable.
.3 Base products:
.1 CFS-BL Fire Block.
.2 CFS-PL Firestop Plug.

.12 Mortar:
.1 Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
.2 Base product:
.1 CP 637 Firestop Mortar.

.13 Silicone Sealants:
.1 Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces pourable or non-sag or vertical surface non-sag.
.2 Base product:
.1 CFS-S SIL GG Elastomeric Firestop Sealant.
.2 CFS-S SIL SL Elastomeric Firestop Sealant.

.14 Preformed Mineral Wool:
.1 CP 767 Speed Strips
.2 CP 777 Speed Plugs

.15 Fire Sealant:
.1 Single component latex or acrylic formulations that upon cure do not re-emulsify during exposure to moisture.
.1 CFS-S SIL GG Elastomeric Firestop Sealant.
.2 CFS-S SIL SL Elastomeric Firestop Sealant.
.3 CFS-SP WB Firestop Joint Spray.

.16 Composite Sheet:
.1 Non-curing, re-penetrable material.
.2 Base Products:
.1 CP 675T Firestop Board.
.2 CFS-BL FireBlock.

.17 Forming Materials:
.1 Materials listed as components in laboratory approved designs.

.2 Mineral Wool insulation to CAN/ULC S702.1 Type 1; preformed mineral fibre, compression fit:

.1 Base Product: SAF by Thermafiber, or

.2 Similar product specifically named as components in laboratory approved designs.

.18 Through Penetration Firestop Systems:

.1 Schedules below identify requirements for acceptable through penetration firestop systems based on barrier type, fire resistive rating, and penetrant type.

.2 Comply with building code and fire code as locally adopted and amended.

.3 Requirements for single membrane penetrations and through penetration firestops are identical.

.1 Unless otherwise noted, treat penetrants which pass through a single membrane same as though passed through entire fire resistive assembly.

.4 Select each firestop system based on actual field conditions, including penetration type, shape, size, quantities, and physical position within opening.

.5 See Drawings for indication of the required ratings of fire resistive wall, floor, and roof assemblies.

.1 Indicated ratings are minimum and may be exceeded.

.6 Firestop assemblies at fire rated walls:

.1 Minimum fire (F) rating for firestop assemblies in walls shall equal that of wall, but not less than 1 HR.

.2 Minimum temperature (T) rating of firestop assemblies in walls may equal zero.

.3 Smoke barrier:

.1 In addition to (F) rating, (L) rating of maximum 5 CUFTM/ SF | 0.000423 m3/s per m2.

.4 Non-rated walls and smoke partitions with no fire resistive requirement:

.1 Assembly with (L) rating.

.7 Firestop assemblies at fire rated floors and roofs:

.1 Minimum fire (F) and temperature (T) ratings of firestop assemblies used in floors or roof shall equal hourly rating of floor or roof being penetrated, but not less than 1 HR.

.1 Exception 1: T-rating may equal zero when portion of penetration, above or below floor, is contained within a wall.

.2 Exception 2: Firestops are not required for floor penetrations within a 2-hour rated shaft enclosure.

.19 Electrical panels and devices, medical gas outlets and valve boxes, and other items recessed in to face of rated walls:

.1 Where electrical devices are placed on opposite sides of wall and are less than 24 IN 610 MM apart measured horizontally, install intumescent pads over back of devices in approved manner or maintain continuity of rated barrier within wall cavity surrounding recessed item.

.20 Fire Resistive Joint Assemblies:

.1 Where joint will be exposed to elements, fire resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920.

.2 Head of Wall Assemblies:

.1 Use at top of fire rated and smoke barrier walls and partitions where they abut floor and roof structures above.

.2 Select systems with D designation, rated for dynamic movement capability.

.3 Select systems that can accommodate deflection of structure above.

.4 Maximum Leakage for Fire resistive Joints in Smoke Barriers: 7.75 L/s or less per linear meter as tested in accordance with UL 2079.

.3 Minimum F and T ratings:

.1 The minimum fire rating for firestop assemblies in walls shall equal that of wall, but not less than 1 HR.

.2 The minimum temperature rating of firestop assemblies in walls may equal zero.

.4 Acceptable Systems:

.1 Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

.21 Fire Rated Enclosures:

.1 Provide where required as part of a CUL Fire Resistance Directory design for fixtures mounted in rated walls or ceilings.

.1 Field constructed enclosures meeting Fire Resistance Directory designs will be accepted.

.2 Include accessories and install according to enclosure manufacturer's written instructions.

3. EXECUTION

3.1 PREPARATION

.1 Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

.2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.

.3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

.4 Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Install firestop systems in accordance with manufacturer's instructions and conditions of testing and classification as specified in CUL or other acceptable third party testing agency listing.

.2 Penetrations through fire resistive floor assemblies shall be sealed with firestop system providing minimum Class 1 W-rating as tested in accordance with CUL 1479 and ensure air and water resistant seal.

.3 Protect materials from damage on surfaces subjected to traffic.

.4 Identification Labels:

.1 Identify each firestop assembly as defined in Quality Assurance.

.2 Do not locate identification labels, tags, or both, on finished surfaces and where exposed to view by public.

3.3 FIELD QUALITY CONTROL

.1 Owner shall engage a qualified independent inspection agency to inspect firestop systems in accordance with ASTM E2174, Standard Practice for On-site Inspection of Installed Fire Stops, and ASTM E2393, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.2 Maintain areas of work accessible until inspection by authorities having jurisdiction.

.3 Where deficiencies are found, repair or replace assemblies to comply with requirements.

3.4 ADJUSTING AND CLEANING

.1 Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

.2 Clean surfaces adjacent to sealed openings free of excess materials and soiling as work progresses.

.3 Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION

FSECTION 08 11 00
HOLLOW METAL DOORS AND FRAMES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Metal doors and frames.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Section 08 70 00 - Finish Hardware.

.2 Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 ASTM International (ASTM):

.1 A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 National Association of Architectural Metal Manufacturers (NAAMM):

.1 Hollow Metal Manufacturers Association (HMMA).

.3 Steel Door Institute (SDI):

.1 117, Manufacturing Tolerances for Standard Steel Doors and Frames.

.2 All SDI publications.

.4 Steel Door Institute/American National Standards Institute (SDI/ANSI):

.1 A250.6, Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

.2 A250.7, Nomenclature for Standard Steel Doors and Steel Frames.

.3 A250.8, Specifications for Standard Steel Doors and Frames.

.4 A250.10, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

.5 A250.11, Recommended Erection Instructions for Steel Frames.

.2 Qualifications: Manufacturer must be current member of SDI, and NAAMM (HMMA).

.3 Wipe coat galvanized steel is not acceptable as substitute for galvanizing finish specified.

1.3 DEFINITIONS

.1 As identified in SDI/ANSI A250.7.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.2 Schedule of doors and frames using same reference numbers as used on Drawings.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Store doors and frames in accordance with SDI/ANSI A250.11.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Metal doors and frames:

.1 Delta Series by Daybar

.2 Ceco Door by ASSA ABLOY.

.3 Steelcraft by Allegion PLC.

.4 Curries by ASSA ABLOY.

2.2 MATERIALS

.1 Steel Sheet: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

.2 Frames: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

.3 Supports and Reinforcing: Hot-dipped galvannealed steel, ASTM A653, A60 coating.

.4 Inserts, Bolts and Fasteners: Manufacturer's standard.

.5 Primer: Manufacturer's standard coating meeting SDI/ANSI A250.10.

.6 Galvannealed Coating Repair: See Specification Section 09 96 00.

.7 Thermal Insulation: Polyurethane, CFC free.

2.3 ACCESSORIES

.1 Frame Anchors:

.1 Jamb anchors:

.1 Masonry wire anchors: Minimum 0.1875 inches wire, galvanized.

.2 Existing wall anchor: Minimum 18 GA, galvanized.

.3 Stud partition and base anchors: Minimum 18 GA, galvanized.

2.4 FABRICATION

.1 General:

.1 SDI/ANSI A250.8.

.2 Fabricate rigid, neat in appearance and free from defects.

.3 Form to sizes and profiles indicated on Drawings.

.1 Beveled edge.

.4 Fit and assemble in shop wherever practical.

.5 Mark work that cannot be fully assembled in shop to assure proper assembly at site.

.6 Continuously wire weld all joints, dress exposed joints smooth and flush.

.7 Fabricate doors and frames to tolerance requirements of SDI 117.

.8 Fit doors to SDI clearances.

.9 All doors shall be handed.

.10 Design and fabricate doors to requirements of the building code.

.2 Hollow Metal Doors:

.1 General:

.1 1-3/4 inches thick.

.2 Fabricate with flush top caps.

.1 Thickness and material to match door face.

.2 Exterior doors: Seal weld top cap to door face and grind smooth and flush.

.3 Interior doors:

.1 Attach top cap to door with concealed fasteners or by welding.

.2 Factory seal if attached with fasteners.

.3 No exposed fasteners will be accepted.

.3 Continuously wire weld all joints and dress, smooth and flush.

.2 Exterior:

.1 Doors 48 inches wide, or less: SDI/ANSI A250.8, Level 3, and physical performance level A, Model 2.

.1 Face sheet minimum thickness: 18 GA.

.2 Insulated: Minimum R11.

.3 Fire rated interior:

.1 SDI/ANSI A250.8, Level 3, and physical performance level A, Model 2.

.2 Face sheet minimum thickness: 18 GA.

.3 FM labeled.

.4 CUL fire labeled.

.5 Comply with CUL 10B and CUL 10C.

.6 Pairs CUL fire labeled without astragal.

.7 Comply with NFPA 80.

.3 Hollow Metal Frames:

.1 Door frames:

.1 Provide 2 inches face at all heads, jambs and mullions for frames in stud walls.

.2 Provide 4 inches face at head where noted on Drawings or required by wall construction.

.3 26 GA galvannealed steel boxes welded to frame at back of all hardware cutouts.

.4 Steel plate reinforcement welded to frame for hinge, strikes, closers and surface-mounted hardware reinforcing.

.1 All plate reinforcement shall meet size and thickness requirements of SDI/ANSI A250.8.

.5 Split type frames not acceptable.

.1 All horizontal and vertical mullions and transom bars shall be welded to adjacent members.

.6 Conceal all fasteners.

.7 Frames shall be set up, all face joints continuously wire welded and dressed smooth.

.8 Exterior (up to 4 feet wide): 16 GA.

.9 Fire rated:

.1 16 GA.

.2 Comply with UL 10B and UL 10C.

.3 Comply with NFPA 80.

.10 Interior: 16 GA.

.11 Provide removable spreaders at bottom of frame.

.4 Prepare for finish hardware in accordance with hardware schedule, templates provided by hardware supplier, and SDI/ANSI A250.6.

.1 Locate finish hardware in accordance with SDI/ANSI A250.8.

.2 See Specification Section 08 70 00 for hardware.

.3 Prepare doors for swing direction indicated.

.1 Preparing doors for non-handed hinges is not acceptable.

.5 After fabrication, clean off mill scale and foreign materials and prime with rust inhibiting primer.

3. EXECUTION

3.1 INSTALLATION

.1 Install doors and frames in accordance with SDI/ANSI A250.11, the building code and manufacturer's instructions.

.2 Plumb, align, and brace frames securely until permanently anchored.

.1 After completion of walls, remove temporary braces and spreaders.

.2 Anchor frames with minimum of three anchors per jamb.

.1 Number and location of anchors shall be in accordance with SDI and frame manufacturer's recommendations.

.3 At new masonry or metal stud construction, place frames in conjunction with construction of walls or partitions.

.1 Masonry construction: Anchor frames using masonry wire anchors.

.2 Metal stud construction:

.1 Anchor frames using steel stud anchors.

.2 Attach wall anchors with self-tapping screws.

.4 At concrete, precast concrete or existing masonry construction, place frames in rough opening using existing opening anchors.

.5 Install fire-rated frames in accordance with NFPA 80 and manufacturer's instructions.

.6 Use plastic plugs to keep silencer holes clear during construction.

.7 Immediately after erection, sand smooth rusted or damaged areas.

.1 Touch-up with rust-inhibiting primer.

.2 Finish paint door and frame in accordance with Specification Section 09 96 00.

.8 Install three silencers on strike jamb of single door frame and two on head of double door frame.

.1 See Specification Section 08 70 00.

.9 Protect doors and frames during construction.

END OF SECTION

SECTION 08 35 13
INDUSTRIAL FOLDING DOORS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Exterior Insulated Industrial Folding Doors

.2 Related Specification Sections include but are not necessarily limited to:

.1 Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 European Standards (EN)

.1 EN12489, Industrial, commercial and garage doors and gates – resistance to water penetration

.2 EN12425, Industrial, commercial and garage doors and gates – resistance to water penetration – Classification

.3 EN12444, Industrial, commercial and garage doors and gates – Resistance to wind load – Testing and calculation

.4 EN12424, Industrial, commercial and garage doors and gates – Resistance to wind load – Classification

.5 EN12427, Industrial, commercial and garage doors and gates – Air permeability – Test method

.6 EN 12426, Industrial, commercial and garage doors and gates – Air permeability – Classification

.2 International Standards Association

.1 ISO 9223, Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation

.2

.3 The Society for Protective Coatings (SSPC):

.1 SP 1, Solvent Cleaning.

.4 The Society for Protective Coatings/NACE International (SSPC/NACE):

.1 SP 6/NACE No. 3, Commercial Blast Cleaning.

.2 Qualifications:

.1 Door manufacturer to have minimum 10 years of experience in manufacture of door system specified.

.2 Installer to be licensed or approved in writing by manufacturer.

.3 References:

.1 Provide minimum five projects completed in past two years having door systems similar to system specified.

.2 Include name of project and contact name and phone number.

1.3 DEFINITIONS

.1 Installer or Applicator:

.1 Installer or applicator is the person actually installing or applying the product in the field at the Project site.

.2 Installer and applicator are synonymous.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Fabrication and/or layout drawings:

.1 Identify all required embedded steel plates, angles or other items.

.1 Provide required sizes and reaction magnitude and direction on embedded items.

.2 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.3 Door installer qualifications.

.4 Provide written certification that doors have been designed and fabricated to withstand loads indicated.

.1 Shop Drawings and written certification to be sealed by structural engineer licensed in the Province of British Columbia.

.3

.4 Schedule of doors using same reference number for openings as indicated on Drawings.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 393 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Listed manufacturers are expected to provide a door and operating system in accordance with this Specification with no deviations unless required structurally for adequate door design.

.2 Industrial folding doors:
.1 Findoor .

.2 Product specified is manufactured by Findoor.

2.2 MATERIALS

.1 Doors:
.1 Structure: thermally insulated, sandwich-structured folding doors
.2 Cladding: heat galvanized sheet steel, minimum thickness of .02" (0.5 mm), painted by heat cured powder coating
.3 Quantity of folds to be determined by the Manufactures based on the door size
.4 Inswing door
.5 Ei30 fire rating
.6 Colour: by Owner from RR Colour chart

.2 Insulation: Manufacturer's standard

.3 Weatherstripping: '
.1 EPDM
.2 Between all panels and door bottom to have double sweep

.4 Guides:
.1 Manufacturer's standard
.2 Interior track
.3 Corrosion proof to ISO 9223 classification C4.

2.3 DOORS AND TRACK

.1 Design Criteria:
.1 Deflection to

.2 Doors - General:
.1 Wind load resistance: Class 4 EN12424
.2 Weatherstripped on top, bottom, sides, meeting edges and between door sections.
.3 Water penetration: Class 3 EN12489
.4 Air permeability: Class 4 EN12426
.5 Finish: Heat cured powder coat

2.4 ACCESSORIES

.1 Hardware:
.1 Hinges:
.1 Hinges: elevating steel hinges with ball bearings

.2 Operating Unit:

3. MANUALLY OPENED DOORS: THE DOOR HAS A HANDLE ON ITS INSIDE SURFACE THAT ALLOWS ITS OPENING OR CLOSING. EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Installation by manufacturer's authorized installer.

.3 Upon completion of installation, lubricate, test and adjust doors to operate smoothly and easily without bow, twist or warp and fitting weathertight at perimeter and at meeting edges of each panel.

.4 Field Painting: See Specification Section 09 96 00.

END OF SECTION

SECTION 08 62 23
TUBULAR DAYLIGHTING DEVICES

1. GENERAL

1.1 SUMMARY

.1 Tubular daylighting devices (TDD) and accessories.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Section 06 10 00 - Wood Framing. Site built wood curbs and nailers.

.2 Section 07 62 00 - Flashing and Sheet Metal. Metal curb flashings.

.3 Section 07 61 13 - Standing Seam Metal Roofing

1.2 REFERENCES

.1 American Architectural Manufacturers Association (AAMA):

.1 AAMA/WDMA/CSA 101/I.S.2/A440 - Standard/Specification for Windows, Doors, and Unit Skylights; 2011.

.2 American National Standards Institute (ANSI):

.1 ANSI C63.4-2014 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

.3 ASTM International (ASTM):

.1 ASTM A463/A463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process.

.2 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process.

.3 ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.4 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.5 ASTM D635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position.

.6 ASTM D1929 - Test Method for Ignition Properties of Plastics.

.7 ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

.8 ASTM F1642 - Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.

.9 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.10 ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

.11 ASTM E283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.12 ASTM E308 - Standard Practice for Computing the Colors of Objects by Using the CIE System.

.13 ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors.

.14 ASTM E547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain walls by Cyclic Air Pressure Difference.

.15 ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials.

.16 ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane.

.17 ASTM F2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loading.

.4 CSA Group (CSA):

.1 CSA C22.2 No. 250.0 - Luminaires.

.5 Factory Mutual (FM):

.1 FM Standard 4431 - The Approval Standard for Skylights.

.6 General Services Administration (GSA):

.1 GSA-TS01-2003: Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.

.7 International Building Code (IBC):

.1 IBC Section 1710 - Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing - Devised by ATI PE); 2012.

.2 IBC Section 2606.7.2 - Installation - Diffuser Fall Out Test (Devised by PE); 2012.

.8 International Code Council Evaluation Service, Inc. (ICC-ES):

.1 ICC-ES AC-16 - Acceptance Criteria for Plastic Skylights; 2008.

.9 Underwriters' Laboratories (UL):

.1 UL 2108 - Low Voltage Lighting Systems.

.2 UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.3 PERFORMANCE REQUIREMENTS

.1 Daylight Reflective Tubes: Spectralight Infinity with INFRAREDuction Technology combines ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Patented spectrally-selective optical surface yields an average total- and specular-reflectance for the Visible Light spectrum (400 nm to 700 nm) providing maximized visible light transmission and less than 25 percent reflectance for Infrared (IR) heat wavelengths (750 nm to 2500 nm) for minimized heat transmission, resulting in a spectrally-selective Total Solar Spectrum (250 nm to 2500 nm) reflectance less than 37 percent, as measured using a Perkin Elmer Lambda 1050 spectrophotometer with a Universal Reflectance Accessory. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance with ASTM E308.

.2 SOLAMASTER 750 DS-O / 750 DS-C (OPEN/CLOSED CEILING)

.1 AAMA/WDMA/CSA 101/IS2/A440, Class CW-PG70, size tested 21 inch (530 mm) diameter, Type TDDOC and Type TDDCC.

.1 Air Infiltration Test:

.1 Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E283.

.2 Water Resistance Test:

.1 Passes water resistance; no uncontrolled water leakage with a pressure differential of 10.7 psf (512 Pa) or 15 percent of the design load (whichever is greater) and a water spray rate of 5 gallons/hour/sf for 24 minutes when tested in accordance with ASTM E547 and ASTM E331.

.3 Uniform Load Test: All units tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E330.

.1 No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).

1.4 SUBMITTALS

.1 Shop Drawing:

.1 Manufacturer's data sheets on each product to be used

.2 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.3 Installer qualifications.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of twenty years experience in the top lighting industry. Secondary products shall be acceptable to the primary manufacturer.

.2 Installer Qualifications: All products shall be installed by a single installer with a minimum of five years demonstrated experience, with adequate equipment, skilled workers, and practical experience to meet the project schedule.

.3 Skylights shall conform with authorities having jurisdiction and be designed to meet design criteria of the project location and the following:

.1 Skylights must be Tested and labeled in accordance with CSA 101/I.S.2/A440.

.2 Skylights shall provide minimum 69 psf (3.30 kPa) design load.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver products in a cool dry location protected from the weather and in the manufacturer's original unopened containers until ready for installation.

.2 Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

.1 Coordinate delivery schedule with the Contractor and project schedule to minimize on site storage.

.2 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.

.3 Store materials in a dry area, protected from freezing, staining, contamination or damage.

1.8 WARRANTY

.1 Daylighting Device: Manufacturer's standard warranty for 10 years.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 SolaTube

.2 Substitutions: Approved Alternatives.

2.2 TUBULAR DAYLIGHTING DEVICES

.1 Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

.2 SolaMaster Series: Solatube Model 750 DS, 21 inch (530 mm) Daylighting System:

.1 Model:

.1 Solatube Model 750 DS-C Closed (Penetrating) Ceiling. AAMA Type TDDCC.

.2 Capture Zone:

.1 Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

.2 Outer Dome Glazing: Type DA, 0.125 inch (3.2 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.

.3 Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.

.2 Acrylic Dome Plus Inner Dome Glazing: Type DPI, Inner Dome is 0.115 inch (3 mm) minimum thickness polycarbonate classified as CC1 material.

.3 Dome Options:

.1 Security Kit: Type SK Dome Security Kit, rivets with nylon spacers to replace dome screws.

.1 Dome Edge Protection Band: Type PB, for fire rated Class A, B or C roof applications. Galvanized steel. Nominal thickness of 0.039 inch (1 mm). For use with all flashing types.

.4 Flashings:

.1 Roof Flashing Base:

.1 One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A653/A653M or ASTM A463/A463M or ASTM A792/A792M, 0.028 inch (0.7 mm) plus or minus .006 inch (.015 mm) thick.

.1 Base Style: Manufacturer's recommendation for application.

.2 Curbs: Metal Insulated Roof Curb: Corrosion resistant 18 Gauge hot-dipped galvanized steel conforming to ASTM A653 G90 with continuous welded seams, integrated base plate for water tightness and extra strength, lined with 1-1/2 inch fiberglass fireproof sound attenuating thermal insulation, factory installed 2 by 2 treated wood nailer secured to top ledge of curb. Curb designed for single-ply roofing, lightweight fill, or tapered insulation low slope roof types.

.1 C16 16 inch (406 mm) high Metal insulated curb

.3 Flashing Options:

.1 Flashing Insulator: Type FI, Thermal isolation material is for use under the following flashing types: Type F4, F8, or F11.

.2 Curb Insulator: Curb Insulator, Type CI, Thermal isolation material is for use under flashing Type FC.

.3 Curb Cap Insulation: Type CCI, Nominal 1 inch thick thermal insulation pad to reduce thermal conduction between curb-cap and tubing and thermal convection between room air and curb-cap. Rated R-6 Insulation is Polyisocyanurate foam utilizing CFC, HCFC, and HFC free blowing agent.

.5 Transfer Zone:

.1 Extension Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm) conforming to ASTM B 209.

.2 Reflective Tubes:

.1 Reflective extension tube, Type EXX and Type EL with total length of run as indicated on the Drawings.

.2 Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.

.3 Manufacturer's recommendation for application

.4 Thermal Insulation Panel: Type TIP, high-performance dual-glazed, thermally-broken tube insulation system.

.6 Delivery Zone:

.1 Diffuser Assemblies for Tubes Penetrating Ceilings: Solatube Model 750 DS-C. Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube; 23.8 inches by 23.8 inches (605 mm by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.

.1 Polymeric Transition Box: Type TP, round-to-square transition box made of opaque polymeric material, classified as CC2, Class C, 0.110 inch (2.8 mm) thick.

.1 Lens: Type L2, Prismatic lens design to maximize light output and diffusion with extruded aluminum frame and EPDM foam seal to minimize condensation and bug, dirt, and air infiltration per ASTM E283. Visible Light Transmission shall be greater than 90 percent at 0.100 inches (2.5 mm) thick. Classified as CC2.

2.3 EXECUTION

.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.

.3 If substrate and rough opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

.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 INSTALLATION

.1 Install in accordance with manufacturer's printed instructions.

.2 Coordinate installation with substrates, air and vapour retarders, roof insulation, roofing membrane, and flashing to ensure that each element of the Work performs properly, and that finished installation is weather tight.

.1 Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.

.2 Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.

.3 Coordinate attachment and seal of perimeter air and vapour barrier material.

.4 Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer

.5 Align device free of warp or twist, maintain dimensional tolerances.

.6 Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

2.4 FIELD QUALITY CONTROL

.1 Provide independent testing and inspection as specified in Section 01 45 23. Inspect installation to verify secure and proper mounting.

.1 Test for water leaks in accordance with AAMA 502 after installation and curing of sealants but prior to installation if interior finishes.

.2 Perform test for total area of each unit skylight.

.3 Notify the Owner and the Contractor of any failed tests.

2.5 CLEANING

.1 Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

2.6 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 70 00
FINISH HARDWARE

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Finish hardware.
- .2 Inspection and testing of door operation.

.2 Related Specification Sections include but are not necessarily limited to:
- .1 Section 08 11 00 - Metal Doors and Frames.
- .2 Section 08 70 00A – Finish Hardware Schedule

1.2 QUALITY ASSURANCE

.1 All door hardware shall be provided by a single hardware supplier.
- .1 Hardware is to be provided under this Specification Section, unless noted otherwise, for doors specified in:
  - .1 Specification Section 08 11 00.

.2 Referenced Standards:
- .1 Americans with Disabilities Act (ADA):
  - .1 Accessibility Guidelines for Buildings and Facilities (ADAAG).
- .2 American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
  - .1 A156.1, Butts and Hinges.
  - .2 A156.3, Exit Devices.
  - .3 A156.4, Door Controls -Closers.
  - .4 A156.6, Architectural Door Trim.
  - .5 A156.8, Door Controls - Overhead Stops and Holders.
  - .6 A156.13, Mortise Locks.
  - .7 A156.16, Auxiliary Hardware.
  - .8 A156.18, Materials and Finishes.
  - .9 A156.21, Thresholds.
- .3 American National Standards Institute/Steel Door Institute (ANSI/SDI).
  - .1 A250.8, Specifications for Standard Steel Doors and Frames (SDI-100).
- .4 Door and Hardware Institute (DHI).
- .5 National Fire Protection Association (NFPA):
  - .1 101, Life Safety Code.

1.3 DEFINITIONS

.1 Installer or Applicator:

.1 Installer or applicator is the person actually installing or applying the product in the field at the Project site.

.2 Installer and applicator are synonymous.

.2 All weather: Capable of operation from -40 to +40 degrees C.

.3 Active Leaf: Right-hand leaf when facing door from keyed side unless noted otherwise on Drawings.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.2 Schedule of all hardware being used on each door.

.1 Number hardware sets and door references same as those indicated on Drawings.

.3 Technical data sheets on each hardware item proposed for use.

.4 Warranty information for all hardware devices having extended warranties.

1.5 WARRANTY

.1 Provide all individual manufacturers' extended warranties as advertised.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Hinges:

.1 Ives Hinges.

.2 Hager Companies.

.3 McKinney Manufacturing Co.

.4 Stanley by dormakaba Holding, Inc.

.2 Locksets and latchsets:

.1 Schlage by Allegion PLC

.2 Best Access Solutions, Inc. by dormakaba Holding, Inc.

.3 Corbin Russwin, Inc. by ASSA ABLOY.

.3 Exit devices:

.1 Von Duprin by Allegion PLC.

.2 Corbin Russwin, Inc. by ASSA ABLOY.

.3 PRECISION by dormakaba Holding, Inc.
.4 SARGENT Manufacturing Company by ASSA ABLOY.

.4 Closers:
.1 LCN by Allegion PLC
.2 Corbin Russwin, Inc. by ASSA ABLOY.
.3 .
.4 Norton by ASSA ABLOY.

.5 Door stops and holders:
.1 Trimco.
.2 Rockwood by ASSA ABLOY.
.3 IVES by Allegion PLC.

.6 Overhead stops:
.1 Glynn-Johnson by Allegion PLC.
.2 Rockwood by ASSA ABLOY.
.3 Trimco.
.4 Rixson by ASSA ABLOY.

.7 Weatherstripping and thresholds:
.1 Zero International, Inc.
.2 Pemko by ASSA ABLOY.
.3 Reese Enterprises, Inc.
.4 National Guard Products.

.8 Door bolts, coordinators and strikes:
.1 IVES by Allegion PLC.
.2 Trimco.
.3 Hager Companies.
.4 Rockwood by ASSA ABLOY.
.5 dormakaba.

.9 Other materials: As noted.

2.2 MATERIALS

.1 General: As indicated in the FABRICATION Article in PART 2 of this Specification Section.

.2 Fasteners: Stainless steel or aluminum.

.3 Closers:
.1 Standard closer:
.1 Shell: Aluminum or cast iron.
.2 Arms and piston: Forged steel.

.4 Kickplates:
.1 Stainless steel.

.5 Thresholds: Aluminum.

.6 Overhead Stops and Wall Stops: Stainless steel or aluminum.

.7 Keys: Brass or bronze.

.8 Weatherstripping and Smoke Seals: Polypropylene, neoprene, or EPDM.

.9 Pulls and Push Plates: Stainless steel.

.10 Silencers: Rubber.

2.3 COMPONENTS

.1 Refer to 08 70 00A

2.4 ACCESSORIES

.1 Keying:
.1 Establish keying with Owner.
.1 Tag and identify keys.
.2 Provide two keys for each lock or cylinder.
.3 Master key and key in groups as directed.
.4 Provide construction master keys for all exterior doors.

.2 Strikes:
.1 Curved lips.
.1 Extended lips when required.
.2 Furnish strike boxes.
.3 Appropriate for function and hardware listed.

2.5 FABRICATION

.1 General:
.1 Generally prepare for Phillips head machine screw installation.
.2 Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
.3 Provide concealed fasteners unless thru bolted.
.4 Through bolt closers on all doors.
.5 Furnish items of hardware for proper door swing.
.6 Furnish lock devices which allow door to be opened from inside room without a key or any special knowledge.

3. EXECUTION

3.1 INSTALLATION

.1 Install products in accordance with manufacturer's installation instructions.
  .1 Perform installation by or under the direct supervision of an AHC.

.2 Provide all hardware in accordance with the building code.

.3 Fit hardware before final door finishing.

.4 Permanently install hardware after door finishing operations are complete.

.5 Locate hardware in accordance with ANSI/SDI A250.8.

.6 Butt Hinges:
  .1 Provide non-removable pin (NRP) at:
    .1 Exterior doors.
    .2 Reverse handed doors equipped with locks.

.7 Closers:
  .1 Mount closers on push side of doors unless noted otherwise.

.8 Provide coordinator when required by hardware specified.

.9 Wall Mount Door Stops:
  .1 Provide where specifically indicated on Hardware Schedule and at doors not otherwise indicated to receive:
    .1 Overhead stop.
    .2 Closer with integral stop.

.10 Floor mounted stops are not acceptable unless noted otherwise in this Specification Section.

.11 Provide silencers for door frames.
  .1 Hollow metal frames: See Specification Section 08 11 00.

.12 Provide weather seal, door sweep and threshold at all exterior doors and where scheduled on interior doors.
  .1 Set thresholds in a full bed of sealant.
  .2 Mount door sweeps on exterior face of door.
  .3 Mount weather seal astragal at meeting edges of pairs of doors on the exterior face of the doors.

.13 Provide smoke seals on all fire rated doors.

.14 Mount kickplates on push side of doors.

3.2 FIELD QUALITY CONTROL

.1 Adjust and check each operating item of hardware to assure proper operation or function.
  .1 Lubricate moving parts with lubricant recommended by manufacturer.

.2 During week prior to startup, make a final check and adjustment of all hardware items.

.1 Clean and lubricate as necessary to assure proper function and operation.

.2 Adjust door control devices to compensate for operation of heating and ventilating equipment.

.3 Inspection and Testing:

.1 AHC shall inspect and test all door assemblies and provide written certification that door assemblies are in proper working order.

.1 Door assemblies required to swing in the direction of egress shall be inspected and tested in accordance with NFPA 101.

.2 Submit documentation and certification of testing in accordance with the certifications paragraph in the SUBMITTALS Article in PART 1 of this Specification Section.

3.3 SCHEDULES

.1 Refer to 08 70 00A.

END OF SECTION

Legend:
Link to catalog cut sheet

Hardware Group No. 001

For use on Door #(s):
D-001

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 114X114MM NRP		630	IVE
1	EA	PANIC HARDWARE	9827-EO		626	VON
1	EA	PANIC HARDWARE	9827-NL		626	VON
1	EA	RIM CYLINDER	20-021		626	SCH
2	EA	OH STOP & HOLDER	100H		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA ST-1358		689	LCN
2	EA	MOUNTING PLATE	4040XP-18		689	LCN
2	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS		630	IVE
2	EA	MEETING STILE	328AA X DH		AA	ZER
1	EA	WEATHER STRIPPING	485A X 2/DW X 2/DH		AL	ZER
2	EA	DOOR SWEEP	8192AA X DR WIDTH		AA	ZER
1	EA	THRESHOLD	626A-223 X OPENING WIDTH		A	ZER

Hardware Group No. 002

For use on Door #(s):
D-002

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 114X114MM NRP		630	IVE
1	EA	FIRE EXIT HARDWARE	XP98-NL-F		626	VON
1	EA	RIM CYLINDER	20-021		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS		630	IVE
1	EA	WEATHER STRIPPING	485A X 2/DW X 2/DH		AL	ZER
1	EA	ASTRAGAL	43SP X DH		SP	ZER
1	EA	DOOR SWEEP	8192AA X DR WIDTH		AA	ZER
1	EA	THRESHOLD	626A-223 X OPENING WIDTH		A	ZER

Hardware Group No. 003

For use on Door #(s):
D-003

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 114X114MM		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-06		626	VON
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS		630	IVE
1	EA	GASKETING	8303AA X 1/DW X 2/DH		AA	ZER

Hardware Group No. 004

For use on Door #(s):
D-004

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA		COMPLETE HARDWARE BY DOOR SUPPLIER		

SECTION 09 29 00
GYPSUM BOARD

1. GENERAL

1.1 SUMMARY

.1 Furnish all labour, materials, tools, equipment, and services for Gypsum Wallboard, as indicated, in accordance with provisions of Contract Documents.

.2 Completely coordinate with work of other trades.

1.2 RELATED SECTIONS

.1 Division 1

.2 Section 06 10 003 Rough Carpentry

.3 Section 07 84 00 Firestopping

.4 Section Mechanical DIV 22

.5 Mechanical DIV 23

.6 Electrical DIV 26

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB 19-21-M Sealing and Bedding Compound, Acoustical.

.3 CAN/CGSB-71.25-M Adhesive for Bonding Drywall to Wood Framing and Metal Studs.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials 5th Edition.

.2 CAN/ULC-S102 Building Materials and Assemblies, Standard Method of Test for Surface Burning Characteristics Building Materials.

.3 ULC CAN-S115 Standard Method of Fire Tests of Firestop Systems.

.4 CAN/CSA A82.27 Gypsum Board.

.3 ASTM Standards:

.1 ASTM A653 / A653 M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

.2 ASTM C36/C36M-12, Gypsum Wallboard.

.3 ASTM C475 / C475M, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.4 ASTM C557 Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.5 ASTM C645 Standard Specification for Non-Structural Steel Framing Members.

.6 ASTM C754 – Installation of Steel Framing Members to receive screw-attached Gypsum Board.

.7 ASTM C840 Application and Finishing of Gypsum Board.

.8 ASTM C841 Installation of Interior Lathing and Furring.

.9 ASTM C954 Standard Specification for Steel Drill Srews for the Application of Gypsum Panel Products or Metl Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.10 ASTM C1002 Steel Drill Screws for Application of Gypsum Board or Metal Plaster Bases.

.11 ASTM C1047 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.12 ASTM C1177/C1177M Standard Specification for Glass Mat Gypsum Substrate for use as Sheathing.

.13 ASTM C1178/C11781 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

.14 ASTM C1278/C1278M7 Standard Specification for Fiber-Reinforced Gypsum Panel.

.15 ASTM C1396M4, Standard Specification for Gypsum Board.

.16 ASTM C1629, Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

.17 ASTM C1658 / C1658M, Standard Specification for Glass-Mat Gypsum Panels.

.18 ASTM D578 / D578M-18 Standard Specification for Glass Fiber Strands

.19 ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

.20 ASTM D3678 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Interior-Profile Extrusions.

.21 ASTM D5034-09(2017) Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).

.22 ASTM E84, Surface-Burning Characteristics of Building Materials.

.23 ASTM E90, Sound Transmission Testing.

.24 ASTM E119, Fire Tests of Building Construction.

.25 ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Subject to Earthquake Ground Motions..

.26 ASTM E966: Standard Guide for Field Measurements of Airborne Sound Insulation of Building Facades and Façade Elements.

.27 Gypsum Association:

.1 GA-216 Application of Finishing of gypsum Panel Products.

.2 GA-234 Control Joints for Fire-Resistance Rated Systems.

.3 GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.

.4 BC Building Code 2018

.5 BC Wall & Ceiling Association, Wall & Ceiling Institute Specifications Standards.

1.4 QUALITY ASSURANCE

.1 Perform Work to ASTM C754 and AWCC/WCI Specifications Standards Manual, latest edition.

.2 Provide products manufactured from materials free of sulfur, formaldehyde, hydrogen sulphide, sulphur dioxide, sulphur or any sulphur by-products or other deleterious chemicals. Natural gypsum ore shall be mined in North America. Synthetic gypsum shall be pure calcium sulfate from domestic sources.

.3 Fire Resistant Rated Assemblies:

.1 For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to CAN/ULC S101 and by an independent testing agency.

.2 Provide materials listed by cUL (Certified for Canada), ULC, or other approved testing laboratory, for construction and rating type indicated.

.4 STC Rated Assemblies:

.1 Provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

.2 Carry out all work in accordance with the applicable regulations and recommendations of the WorkSafeBC

.5 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.6 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience and Certified Wall and Ceiling Installer in the Red Seal trade.

1.5 SUBMITTALS

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

.2 Product Data:

.1 Provide copies of manufacturer’s specifications and installation instructions for each type of material and accessory required.

.2 Where fire resistance classification is indicated, submit copies of nationally recognized testing laboratory listings of products proposed for use.

.3 Include data required to show specification compliance.

1.6 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire rated assemblies in conjunction with Section 06 10 003, and 06 11 00, 05 41 00 and 09 22 16 as follows:

.1 Fire Rated Partitions: Listed assembly by ULC listed Design Assembly and as detailed.

.2 Fire Rated Structural Column Framing: Listed assembly by ULC listed Design Assembly as scheduled or detailed.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

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

.2 Deliver and store material undamaged in original wrapping or containers with manufacturer's labels intact.

.3 Prevent damage to materials during handling and storage. Keep gypsum wallboard and cementitious materials under cover and free from dampness.

.4 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10°C, maximum 21°C for 7 days prior to and during application of gypsum boards and joint treatment, and for at least 4 days after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Provide proper ventilation to eliminate excessive moisture and humidity.

.4 Provide adequate lighting to carry out the work.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with local regulations.

.2 Do not dispose of unused materials into landfill. Divert materials to municipal hazardous materials depot.

.3 Divert unused materials from landfill to recycling facility.

1.10 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of Service Commencement.

.2 Warranty: Include coverage to correct defective work and for failure to meet specified requirements.

2. PRODUCTS

.1 Fire and Mold rated Gypsum Wall Board to ASTM C1396:

.1 Thickness 15.9mm (5/8")
.2 Mould and Mildew Resistance
.3 Type X with abuse resistance
.4 Base Product: Sheetrock Glass-Matt Mold Tough Firecode X
.5

.2 Gypsum Board Screws: To ASTM C1002, self-drilling, self-threading, case hardened screws with Philips type head, suitable for penetration of 0.91 mm thick steel and as required for appropriate fir rating design.

.3 Joint Treatment Material: Joint compound, joint tape and taping compound to conform to ASTM C475.

2.2 TRIM ACCESSORIES

.1 General Interior Trim: Comply with ASTM C1047.
  .1 Material for general, interior uses: Galvanized or aluminum coated steel sheet, rolled zinc, or paper faced structural laminate or paper faced galvanized steel sheet.
  .2 Material for wet and high humidity and exterior areas: Composite.
.2 Shapes:
  .1 Corner bead.
  .2 Bullnose corner bead.
  .3 LC-Bead: J-shaped; exposed long flange receives joint compound.
  .4 L-Bead: L-shaped; exposed long flange receives joint compound.
  .5 U-Bead: J-shaped; exposed short flange does not receive joint compound.
  .6 Expansion / control joint. To ASTM C1047, Control joint #093, 3 m lengths, roll-formed zinc with a tape protected 6 mm opening, 11 mm deep.
  .7 Curved-Edge Corner bead: With notched or flexible flanges.
  .8 Other items as indicated.

.2 General Exterior Trim:
.1 General:
  .1 Comply with ASTM C1047.
  .2 Material: Zinc.
.2 Shapes:
  .1 Corner bead.
  .2 LC-Bead: J-shaped; exposed long flange receives joint compound.
  .3 Expansion (control) joint.
  .4 Other items as indicated.

2.3 JOINT TREATMENT MATERIALS

.1 General:

.1 Joint compound, joint tape and taping compound to comply with ASTM C475 and ASTM C840.

.2 Materials compatible with other compounds applied previously or on successive coats.

.2 Joint Tape:

.1 Interior Gypsum Wallboard: 50 mm spark perforated paper tape made from 100% recycled paper, of type recommended by manufacturer of gypsum board products.

.1 Fiber glass tape not acceptable.

.3 Joint Compounds for Interior Gypsum Wallboard: ASTM C475 and ASTM C840.

.1 Setting type joint compound:

.1 Filling open joints and voids.

.2 Embedding tape and first coat over joints, fasteners and trim flanges.

.2 Lightweight setting type joint compound:

.1 Second coat.

.2 Final, skim coat on surfaces receiving a Level 5 finish.

.3 Drying type all-purpose joint compound:

.1 Second and third coats.

.2 Final, skim coat, on surfaces receiving a Level 5 finish.

.4 Spray applied coating compound:

.1 Final, skim coat, on surfaces receiving a Level 5 finish.

.3 Joint compounds for moisture resistant gypsum wallboard:

.1 Setting type joint compound:

.1 Filling open joints and voids.

.2 Embedding tape and first coat over joints, fasteners and trim flanges.

.2 Lightweight setting type joint compound:

.1 Second and third coats.

.2 Final, skim coat on surfaces receiving a Level 5 finish.

.4 Manufacturer's recommended type for use with selected materials, mildew resistant, non-staining type, asbestos free and with a VOC content of 50 g/L or less.

3. EXECUTION

3.1 INSPECTION AND PREPARATION

.1 Examine supporting structure and conditions prior to wallboard installation.

.2 Correct unsatisfactory conditions.

.3 Start of installation assumes responsibility for shielding integrity of system.

.4 Verify areas scheduled to receive radiation shielding are suitable for installation.

3.2 INSTALLATION – GENERAL

.1 General Requirements:

.1 Comply with ASTM C840.

.2 Install products per manufacturer's specific installation instructions.

.3 Remove loose materials and vacuum cavity of gypsum dust prior to enclosing stud space.

.2 Bring boards into contact but do not force into place.

.3 Stagger edge joints on opposite side of partition so they occur on different framing members.

.4 Stagger joints in multi-layer applications not less than one support from previous layer.

.5 Proceed with attachment from board center toward ends and edges.

.6 Install with 6 mm 1/4 IN gap between gypsum board and floor.

.7 Seal ends, cutouts, and screw penetrations of moisture resistant boards with sealer.

.8 Install wallboard over metal framing studs and similar framing support members at interior face of exterior walls full height from floor to structure above.

3.3 INSTALLATION – CEILING

.1 Install in compliance with manufacturer's recommendations.

.2 Stagger abutting end joints of adjacent panels' not less than one framing member.

.3 Stagger abutting end joints of adjacent panels' not less than one framing member.

.4 Install fire rated ceiling assemblies as indicated.

.5 Access Panels and Doors: Locate where required by Mechanical and electrical divisions.

3.4 WALLBOARD FINISHING

.1 General:

.1 Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

.2 Promptly remove residual joint compound from adjacent surfaces.

.2 Pre-fill open joints and voids, rounded or beveled edges, and damaged surface areas.

.3 Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

.4 Where wallboard abuts dissimilar surfaces: Securely attach continuous trim beads in accordance with manufacturer's directions.

.5 Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.

.6 Apply Joint Compound and Tape in accordance with fire-rated design.

.7 Level 5 Finish:

.1 Comply with ASTM C840.

.2 Trowel skim coat of joint compound leaving a thin film covering the entire surface, in accordance with manufacturer's recommendations.

.3 Make surfaces free of tool marks and ridges.

.4 Locations:

.1 All locations.

.8 Repairs:

.1 After painter has applied primer to wallboard surfaces, repair and refinish defective areas.

.2 If wallboard is damaged, or surfaces are roughened, repair, or remove and replace, to satisfaction of Architect, at no additional cost to Owner.

3.5 PROTECTION

.1 Protect installed wallboard from water damage during construction.

.2 Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

.3 Remove and replace panels that are wet, moisture damaged, and mold damaged.

.1 Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

.2 Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

.4 Prior to finishing, walls shall be inspected for visible mold growth.

.1 Replace affected portions.

END OF SECTION

SECTION 09 67 23
RESINOUS FLOORING

1. GENERAL

1.1 SUMMARY

.1 This section covers the supply and installation of fluid applied epoxy flooring.

.1 All concrete surfaces below the masonry walls are to be coated. In general this includes:

.2 All concrete floors

.3 Curbs around all walls and floor penetrations.

.4 Equipment pads, both sides and surfaces under equipment (up to 200 mm above finished floors).

.5 Concrete plinths.

1.2 QUALITY ASSURANCE

.1 Strictly adhere to all manufacturer's printed recommendations with respect to drying times, application method, mixing instruction, application equipment, pot life, thinning and any other manufacturer's recommendations deemed applicable by the Contract Administrator.

.2 The applicator shall have a minimum of 2 years experience installing the approved flooring system.

1.3 DEFINITIONS

.1 Applicator:

.1 Applicator is the person actually installing or applying the product in the field, at the Project site, or at an approved shop facility.

.2 Finished Area: A room or area that is listed in or has finish called for on Room Finish Schedule or is indicated on Drawings to be coated.

1.4 SUBMITTALS

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 Standard products of manufacturers other than those specified will be accepted if it can be demonstrated to the Contract Administrator that they are equal in composition, durability, usefulness, and convenience for the purpose intended. Requests for substitutions will be considered, provided the following minimum conditions are met and submitted for review in accordance with Section 01 25 00.

.3 The proposed coating system must use coatings of the same generic type as that specified.

.4 Submittals to include directions for application, generic type, percent solids by volume, volatile organic content (grams per litre), and information confirming that the substitution is equal to the specified coating system.

.5 Submit colour chart in accordance with Section 01 33 00.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver in original containers, labeled as follows:

.1 Name or type number of material.

.2 Manufacturer's name and item stock number.

.3 Contents, by volume, of major constituents.

.4 Warning labels.

.2 Store materials in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 10 DEGC

2. PRODUCTS

2.1 MANUFACTURES

.1 Standard of acceptance: Stonekote HT4 by Stonecor; Primer HT Primer.

2.2 MATERIALS

.1 The approved product shall have an excellent rating for exposure to chlorine at concentrations <5%.

.2 Physical characteristics:

.1 Percent solids: min 90%

.2 Hardness: (ASTM D2240) 55

.3 Colour: Pewter

.4 Applied Thickness: 4-6 mil

3. EXECUTION

3.1 ENVIRONMENTAL CONTROL

.1 Ensure minimum ambient temperature of 16 °C, humidity less than 80%.

.2 Ensure all surfaces are clean, dry and prepared in accordance with the manufacture’s recommendations.

.3 Ensure the surface remains dry for a minimum of 24 hours following flooring application.

3.2 SAFETY

.1 Provide approved respirators and goggles to all workers during the installation of the flooring.

.2 Take all necessary steps to minimize all non-related activities within the building during the installation of the flooring.

3.3 APPLICATION

.1 Ensure floor is free of all dirt, wax, oil, fats, soils, loose particles, laitances and foreign substances.

.2 Unbonded cement particles must be removed by abrasive blasting or scarifying in accordance with the suppliers recommendations.

.3 Apply primer as recommended by supplier.

.4 Mix in accordance with recommendations from supplier.

.5 Apply within the approved pot life of material.

.6 Protect floor for minimum duration recommended by manufacturer.

.1 24-hrs to light service including pedestrian traffic

.2 7-days for any wheel loading.

3.4 CLEAN-UP

.1 Clean-up all surfaces not to be coated in accordance with the product documentation.

END OF SECTION

SECTION 09 91 10
ARCHITECTURAL PAINTING

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Surface Preparation.
- .2 Field application of:
  - .1 Architectural Coatings.

.2 Related Specification Sections include but are not necessarily limited to:
- .1 Division 03 - Concrete.
- .2 Division 04 - Masonry.
- .3 Section 08 11 00 - Metal Doors and Frames.
- .4 Section 09 29 00 - Gypsum Board.
- .5 Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:
- .1 ASTM International (ASTM):
  - .1 D523, Standard Test Method for Specular Gloss.
  - .2 D4258, Standard Practice for Surface Cleaning Concrete for Coating.
  - .3 D4259, Standard Practice for Abrading Concrete.
  - .4 D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
  - .5 D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
  - .6 D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
  - .7 F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
  - .8 E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 National Fire Protection Association (NFPA):
  - .1 101, Life Safety Code.
- .3 Steel Door Institute/American National Standards Institute (SDI/ANSI):
  - .1 A250.10, Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces for Steel Doors and Frames.
- .4 The Society for Protective Coatings (SSPC):

.1 SP 1, Solvent Cleaning.
.2 SP 2, Hand Tool Cleaning.
.3 SP 3, Power Tool Cleaning.
.4 SP 16, Brush-off Blast Cleaning of Non-Ferrous Metals.

.5 The Society for Protective Coatings/NACE International (SSPC/NACE):
.1 SP 6/NACE No. 3, Commercial Blast Cleaning.
.2 SP 7/NACE No. 4, Brush-off Blast Cleaning.
.3 SP 13/NACE No. 6, Surface Preparation of Concrete.

.6 United States Environmental Protection Agency (EPA).

.2 Miscellaneous:
.1 Coating used in all corridors and stairways shall meet requirements of NFPA 101 and ASTM E84.

1.3 DEFINITIONS

.1 Installer or Applicator:
.1 Installer or applicator is the person actually installing or applying the product in the field at the Project site.
.2 Installer and applicator are synonymous.

.2 Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified.

.3 Exposed Exterior Surface:
.1 Exterior surface which is exposed to view.
.2 Exterior surface which is exposed to weather but not necessarily exposed to view.

.4 Finished Area:
.1 An area that is listed in or has finish called for on Room Finish Schedule.
.2 An area that is indicated on Drawings to be painted.

.5 Gloss Range:
.1 Specular gloss measured in accordance with ASTM D523:
.1 Flat: Below 15, at 60 degrees.
.2 Eggshell: Between 20 and 35, at 60 degrees.
.3 Semi-gloss: Between 35 and 70, at 60 degrees.
.4 Gloss: More than 70, at 60-degrees.

.6 Paint includes the following:
.1 Architectural paints (AP) include: Acrylic latex or alkyd enamel coatings.
.2 Special coatings (SC) include: Water-based pigmented resin particles suspended in acrylic latex solution.
.3 Stains and varnish include: Alkyd stain and polyurethane varnish.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's surface preparation instructions.

.3 Manufacturer's application instructions.

.2 Samples:

.1 Manufacturer's full line of colors for Engineer's preliminary colour selection.

.2 After preliminary colour selection by Engineer provide two (2) 8 by 10 inches samples of each final color and sheen selected.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver in original containers, labeled as follows:

.1 Name or type number of material.

.2 Manufacturer's name and item stock number.

.3 Contents, by volume, of major constituents.

.4 Warning labels.

.5 VOC content.

.2 Store materials in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 10 degrees C.

1.6 PROJECT CONDITIONS

.1 Verify that atmosphere in area where painting is to take place is within paint manufacturer's acceptable temperature, humidity and sun exposure limits.

.1 Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.

.1 Provide temporary dehumidification equipment properly sized to maintain humidity levels required by paint manufacturer.

.2 Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 hour basis.

.1 Vent exhaust gases to exterior environment.

.2 No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.

.2 Do not apply coatings in snow, rain, fog or mist.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Provide products from a single manufacturer to the greatest extent practicable.

.2 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Architectural paints:

.1 Benjamin Moore & Co.

.2 PPG.

.3 Sherwin-Williams.

.4 Tnemec, Inc.

2.2 MATERIALS

.1 General:

.1 For unspecified materials such as thinner, provide manufacturer's recommended products.

.2 Unless noted otherwise, products listed are manufactured by the manufacturer listed below.

.1 Products of other manufacturers will be considered for use provided that the product:

.1 Is of the same generic formulation.

.2 Has comparable application requirements.

.3 Meets the same VOC levels or better.

.4 Provides the same finish and color options.

.3 Colours:

.1 Colours and gloss will be selected from the manufacturer’s complete offering.

.2 Architectural Paints:

.1 Product List:

Generic Description	Product
Acrylic Primer	PPG Pure Performance 9-900
Acrylic Latex	PPG Pure Performance 9-100/9-300/9-500 Series
Acrylic Gloss	PPG Speedhide 6-8534 Series
Concrete Filler/Surfacer	Tnemec Series 215 and/or Series 218
CMU Block Filler	Tnemec Series 54 Masonry Filler
Dry-Fall Primer	Tnemec Series V115 Uni-Bond DF
Epoxy Barrier Coat	Tnemec Series 135 Chembuild
Fluoropolymer	Tnemec Series 1070V/1071V/1072V Fluoronar
HDP Acrylic	Tnemec Series 1028/1029 Enduratone
Organic Zinc Primer	Tnemec Series 94-H2O Hydro-Zinc
Polycarbamide	Tnemec Series 740/750 UVX
Waterborne Acrylate	Tnemec Series 156 Enviro-Crete

2.3 PAINT SYSTEMS

.1 General:

.1 Refer to Specification Section 09 96 00 for:

.1 Items in corrosive or highly corrosive environments.

.2 Items subject to immersion service.

.3 Items subject to exterior exposure.

.4 Any other locations where High Performance Industrial Coatings (HPIC) are required.

.2

.2 Schedule:

Substrate	Prime Coat[1]	Intermediate Coat(s)[1]	Finish Coat[1]
Concrete	Concrete Filler/Surfacer as necessary to fill all voids and depressions	100 to 200 square feet/GAL Waterborne Acrylate	100 to 200 square feet/GAL Waterborne Acrylate
Concrete Masonry	80 to 100 square feet/GAL CMU Block Filler	100 to 200 square feet/GAL Waterborne Acrylate	100 to 200 square feet/GAL Waterborne Acrylate
Structural Steel and Miscellaneous Metals[3]	2.5 to 3.5 mil Organic Zinc Primer	2.0 to 3.0 mil HDP Acrylic[2]	2.0 to 3.0 mil HDP Acrylic[2]
Hollow Metal Door - Interior	4.0 to 5.0 mil DFT Epoxy Barrier Coat	2.0 to 3.0 mil HDP Acrylic[2]	2.0 to 3.0 mil HDP Acrylic[2]
Hollow Metal Door - Exterior	4.0 to 5.0 mil DFT Epoxy Barrier Coat	2.5 to 3.5 mil Polycarbamide[2]	2.5 to 3.5 mil Polycarbamide[2]
Gypsum Board	300 to 400 square feet/GAL Acrylic Primer	300 to 400 square feet/GAL Acrylic Latex [2]	300 to 400 square feet/GAL Acrylic Latex [2]

1. Application rates (SF/GAL) shown are for unthinned materials.
2. Sheen as scheduled or selected.
3.

3. EXECUTION

3.1 ITEMS TO BE PAINTED

.1 Exterior surfaces, including but not limited to:

.1 Doors and frames:

.1 Hollow metal doors and frames.

.2 Interior Areas:

.1 Refer to Room Finish Schedule on Drawings.
  .1 If space is scheduled to be painted, paint all appurtenant surfaces within the space unless specifically noted otherwise.
  .2 Provide coating manufacturer's recommended bonding primer.
  .3 Appurtenant surfaces include but are not limited to:
    .1 Underside of ceiling.
    .2 Miscellaneous ferrous metal surfaces.
.2 Concrete ring beams
.3 Concrete masonry.
.4 Doors and frames:
  .1 Hollow metal doors and frames
  .2 Hollow metal window frames.
  .3 Folding industrial doors.

3.2 ITEMS NOT TO BE PAINTED

.1 General: Do not paint items listed in this Article, unless noted otherwise.

.2 Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

.3 Electrical equipment.

.4 Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.

.5 Code labels, equipment identification or rating plates and similar labels, tagging and identification.

.6 Contact surfaces of friction-type structural connections.

.7 Stainless steel surfaces.

.8 Fiberglass Surfaces

.9 Galvanized steel items, unless specifically noted to be painted.

.10 Architectural finishes:
  .1 Standing seam metal roof, fascia, trim, soffit and accessories.

3.3 EXAMINATION

.1 Concrete:
  .1 Test pH of surface to be painted in accordance with ASTM D4262.
    .1 If surface pH is not within paint manufacturer's required acceptable range, use methods acceptable to paint manufacturer as required to bring pH within acceptable range.
    .2 Retest pH until acceptable results are obtained.

.2 Verify that moisture content of surface to be painted is within paint manufacturer's recommended acceptable limits.

.1 Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.

.1 If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869.

.2 Provide remedial measures as necessary to bring moisture content within paint manufacturer's recommended acceptable limits.

.3 Retest surface until acceptable results are obtained.

.2 Concrete Unit Masonry:

.1 Test pH of surface to be painted in accordance with ASTM D4262.

.1 If surface pH is not within paint manufacturer's required acceptable range, use methods acceptable to paint manufacturer as required to bring pH within acceptable limits.

.2 Retest pH until acceptable results are obtained.

.2 Verify that moisture content of surface to be painted is within paint manufacturer's recommended acceptable limits.

.1 Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.

.1 If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869.

.2 Provide remedial measures as necessary to bring moisture content within paint manufacturer's recommended acceptable limits.

.3 Retest surface until acceptable results are obtained.

3.4 PREPARATION

.1 General:

.1 Prepare surfaces to be painted in accordance with paint manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.

.1 Where discrepancy between paint manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.

.2 Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of paint to surface.

.3 Adhere to manufacturer's recoat time surface preparation requirements.

.1 Surfaces that have exceeded paint manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional paint in accordance with manufacturer's published recommendations.

.2 Protection:

.1 Protect surrounding surfaces not to be coated.

.2 Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

.3 Prepare and paint before assembly all surfaces which are inaccessible after assembly.

.4 Existing Surfaces:

.1 Wherever existing work is cut, patched or modified; repair and repaint to match new work.

.2 Where a wall or ceiling is disturbed and patched, paint entire wall or ceiling.

.5 Ferrous Metal:

.1 Complete fabrication, welding or burning before beginning surface preparation.

.1 Chip or grind off flux, spatter, slag or other laminations left from welding.

.2 Remove mill scale.

.3 Grind smooth rough welds and other sharp projections.

.2 Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.

.3 Exterior exposure:

.1 Commercial blast clean in accordance with SSPC SP 6/NACE No. 3.

.4 Interior exposure:

.1 Hand tool cleaning in accordance with SSPC SP 2 and/or power tool cleaning in accordance with SSPC SP 3.

.6 Hollow Metal:

.1 Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.

.2 Lightly sand primed surfaces with fine grit sandpaper as recommended by hollow metal manufacturer.

.7 Galvanized Steel and Non-ferrous Metals:

.1 Solvent clean to remove all dust, grease, oil, compounds, dirt and other foreign matter.

.2 Brush-off blast in accordance with SSPC SP 16 or hand tool cleaning in accordance with SSPC SP 2 to remove surface contaminants.

.8 Gypsum Wallboard:

.1 Repair minor irregularities left by finishers.

.2 Avoid raising nap of paper face on gypsum wallboard.

.3 Verify moisture content is less than 8% before painting.

.4 After application of prime coat and between subsequent coats, inspect surface and repair holes, dents, irregularities or other defects as necessary to provide a smooth, uniform finish.

.9 Concrete:

.1 Cure for minimum of 28 days.

.2 Clean in accordance with ASTM D4258.
.1 Remove all soil, grease, oil, or other surface contaminants.
.3 Grind fins and protrusions in accordance with ASTM D4259, flush to plane of wall.
.4 Abrasive blast in accordance with ASTM D4259 and SSPC SP13/NACE No. 6.
.1 Remove all laitance, efflorescence, scabbing and other foreign matter.
.2 Provide minimum concrete surface profile CSP 3 per ICRI 310.2.
.5 Test pH and moisture content in accordance with EXAMINATION article in this specification section.
.6 Repair tie holes, voids, bugholes or other surface defects as necessary to provide smooth, uniform surface.

.10 Concrete Unit Masonry:
.1 Cure for minimum of 28 days.
.2 Remove all mortar spatters and protrusions.
.3 Clean in accordance with ASTM D4261.
.1 Remove all soil, grease, oil, efflorescence.
.4 Test pH and moisture content in accordance with EXAMINATION article in this specification section.

3.5 APPLICATION

.1 General:
.1 Thin, mix and apply paints in accordance with manufacturer's installation instructions.
.1 Where discrepancy exists between manufacturer’s instructions and this Specification Section, the more stringent requirement shall apply.
.2 When materials have been thinned, adjust application rates as necessary to achieve film coverage indicated in Part 2 for unthinned materials.
.3 Backroll spray applied paints.
.2 Temperature and weather conditions:
.1 Do not paint surfaces when surface temperature is below 50 degrees F unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
.2 Avoid painting surfaces exposed to hot sun.
.3 Do not paint on damp surfaces.
.3 Apply materials under adequate illumination.
.4 Evenly spread to provide full, smooth coverage.
.1 All paint systems are "to cover."
.1 When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.

.2 Finished paint system shall be uniform and without voids, bugholes, holidays, laps, brush marks, roller marks, runs, sags or other imperfections.

.5 If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.

.6 Work each application of material into corners, crevices, joints, and other difficult to work areas.

.7 When painting rough surfaces, hand brush and backroll paint to work into all recesses.

.8 Smooth out runs or sags immediately, or remove and recoat entire surface.

.9 Allow preceding coats to dry before recoating.

.1 Recoat within time limits specified by paint manufacturer.

.2 If recoat time limits have expired re-prepare surface in accordance with paint manufacturer's printed recommendations.

.10 Allow coated surfaces to cure prior to allowing traffic or other work to proceed.

.11 Finish colors not otherwise indicated shall be selected by Engineer from paint manufacturer’s complete offering.

.2 Fillers, surfacers or patching compounds:

.1 Provide fillers, surfacers or patching compounds in accordance with manufacturer’s recommendations and as specified herein as necessary to provide a smooth, defect free substrate.

.3 Prime Coat Application:

.1 Prime all surfaces indicated to be painted.

.1 Apply prime coat in accordance with paint manufacturer's written instructions and as written in this Specification Section.

.2 Ensure field-applied paints are compatible with factory-applied paints or existing coatings.

.1 Employ services of coating manufacturer's qualified technical representative.

.1 Certify through material data sheets.

.2 Perform test patch.

.2 If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.

.3 At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.

.1 All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.

.3 Special coatings prime coat application:

.1 Prime new gypsum board surfaces using sealer as recommended by manufacturer.

.1 Apply at rate per manufacturer's recommendation.

.2 Prime and fill new concrete and masonry using sealer coat as recommended by manufacturer followed by modified epoxy filler as specified.

.3 Prime filled concrete and masonry surfaces with primer at rates and as recommended by manufacturer.

.4 Back prime all wood scheduled to be painted, prior to installation.

.5 Touch up damaged primer coats prior to applying finish coats.

.1 Restore primed surface equal to surface before damage.

.4 Finish Coat Application:

.1 Apply finish coats in accordance with paint manufacturer's written instructions and in accordance with this Specification Section.

.2 Touch up damaged finish coats using same application method and same material specified for finish coat.

.1 Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

.3 Hollow metal frames and doors:

.1 Finish coats shall be spray applied only.

.2 Finish edges same as faces of doors.

.4 Varnish:

.1 Apply first coat of varnish: Gloss.

.1 Allow to dry a minimum of 48 hours.

.2 Apply second and third coats of varnish: Satin.

.1 Allow a minimum of 48 hours between each coat.

.3 Lightly sand between coats as required and remove dust.

3.6 FIELD QUALITY CONTROL

.1 Application Deficiencies:

.1 Surfaces showing runs, laps, brush marks, telegraphing of surface imperfections or other defects will not be accepted.

.2 Surfaces showing evidence of fading, chalking, blistering, delamination or other defects due to improper surface preparation, environmental controls or application will not be accepted.

.2 Provide protection for painted surfaces.

.1 Surfaces showing soiling, staining, streaking, chipping, scratches, or other defects will not be accepted.

.3 Provide wet paint signs.

3.7 CLEANING

.1 Clean paint spattered surfaces.

.1 Use care not to damage finished surfaces.

.2 Remove masking, adhesive residue or other foreign materials.

.3 Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

.4 Remove surplus materials, scaffolding, and debris.

END OF SECTION

SECTION 09 96 00
HIGH PERFORMANCE INDUSTRIAL COATINGS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 High performance industrial coatings (HPIC).

.2 Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.

.3 Minimum surface preparation requirements.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Division 00 - Procurement and Contracting Requirements.

.2 Division 01 - General Requirements.

.3 Section 01 61 03 - Equipment - Basic Requirements.

.4 Division 26 - Electrical.

.5 Division 40 - Process Interconnections.

.6 Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 ASTM International (ASTM):

.1 B499, Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals.

.2 D3359, Standard Test Methods for Rating Adhesion by Tape Test.

.3 D4258, Standard Practice for Surface Cleaning Concrete for Coating.

.4 D4259, Standard Practice for Abrading Concrete.

.5 D4261, Standard Practice for Surface Cleaning Concrete Masonry Units for Coating.

.6 D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.

.7 D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

.8 D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages.

.9 D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

.10 D6132, Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gage.

.11 D6677, Standard Test Method for Evaluating Adhesion by Knife.

.12 D7091, Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.

.13 D7234, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

.14 E337, Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures).

.15 F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.16 F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

.2 Environmental Protection Agency (EPA).

.3 International Concrete Repair Institute (ICRI):

.1 310.2, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

.4 NACE International (NACE).

.5 National Association of Pipe Fabricators (NAPF):

.1 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings:

.1 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe.

.2 500-03-05, Abrasive Blast Cleaning for Cast Ductile Iron Fittings.

.6 NSF International (NSF).

.1 61, Drinking Water System Components - Health Effects.

.7 The Society for Protective Coatings (SSPC):

.1 PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements.

.2 SP 1, Solvent Cleaning.

.3 SP 2, Hand Tool Cleaning.

.4 SP 3, Power Tool Cleaning.

.5 SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

.8 The Society for Protective Coatings/ NACE International (SSPC/ NACE):

.1 SP 5/ NACE No. 1, White Metal Blast Cleaning

.2 SP 6/ NACE No. 3, Commercial Blast Cleaning.

.3 SP 7/ NACE No. 4, Brush-off Blast Cleaning.

.4 SP 10/ NACE No. 2, Near-White Blast Cleaning.

.5 SP 13/ NACE No. 6, Surface Preparation of Concrete.

.2 Qualifications:

.1 Coating manufacturer's technical representative shall be a NACE Certified Coatings Inspector, Level 3 minimum.

.2 Applicators shall have minimum of 10 years of experience in application of similar products on similar project.

.1 Provide references for minimum of three different projects completed in last five years with similar scope of work.

.2 Include name and address of project, size of project in value (coating) and contact person.

.3 NACE inspector shall be NACE Certified Coatings Inspector Level 3 minimum and shall have minimum of five years of experience of conducting inspections and tests as indicated in this Specification Section.

.3 Miscellaneous:

.1 Furnish coating through one manufacturer unless noted otherwise.

.4 Deviation from specified MIL thickness or product type is not allowed without written authorization of Engineer.

.5 Material shall not be thinned unless approved, in writing, by coating manufacturer's technical representative.

1.3 DEFINITIONS

.1 Applicator:

.1 Applicator is the person actually installing or applying the product in the field, at the Project site, or at an approved shop facility.

.2 Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified or in Specification Section 01 61 03.

.3 Appurtenant Surface: Accessory or auxiliary surface attached to or adjacent to a surface indicated to be coated.

.4 Corrosive Environment:

.1 Immersion in or subject to:

.1 Condensation, spillage or splash of a corrosive material such as water, wastewater or chemical solution.

.2 Exposure to corrosive caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions.

.3 For purposes of this Specification Section, corrosive environments include:

.1 Outdoor areas not otherwise identified as highly corrosive.

.2 Piping galleries.

.3 Surfaces within 600mm of high water level.

.5 Outdoor Atmosphere or Surface: Outdoor atmosphere or surface exposed to weather and/or direct sunlight.

.6 Finished Area: A room or area that is listed in or has finish called for on Room Finish Schedule or is indicated on Drawings to be coated.

.7 Holiday:

.1 A void, crack, thin spot, foreign inclusion, or contamination in the coating that significantly lowers the dielectric strength of the coating.

.2 May also be identified as a discontinuity or pinhole.

.8 HPIC: High performance industrial coatings.

.1 Epoxies, urethanes, vinyl ester, waterborne vinyl acrylic emulsions, acrylates, silicones, alkyds, acrylic emulsions and any other coating listed as a HPIC.

.9 Interior Atmosphere or Surface: Indoor atmosphere or surface not exposed to weather and/or direct sunlight.

.10 Immersion Service:

.1 Any surface immersed in water or some other liquid.

.2 Surface of any pipe, valve, or any other component of the piping system subject to frequent wetting.

.3 Surfaces within two feet above high water level in water bearing structures.

.11 Piping System: Pipe, valves, fittings and accessories.

.12 Surface Hidden from View:

.1 Within pipe chases.

.2 Between top side of ceilings and underside of floor or roof structures above.

.13 Vapor Space: Interior space within tankage, closed structures, or similar elements that is above the low liquid line and subject to the accumulation of fumes, vapor and/or condensation.

1.4 SUBMITTALS

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 Certifications:

.1 Applicator experience qualifications.

.1 No submittal information will be reviewed until Engineer has received and approved applicator qualifications.

.2 NACE inspector certification.

.3 NACE inspector experience qualifications.

.4 Certification that High Performance Coating Systems proposed for use have been reviewed and approved by a NACE Certified Coatings Inspector employed by the coating manufacturer.

.1 Submittals not including this certification will be returned without review.

.3 Shop Drawings:

.1 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's surface preparation instructions.

.3 Manufacturer's application instructions.

.1 Manufacturer's standard details, including but not limited to penetrations, transitions, and terminations for:

.1 High-build coatings on concrete.

.2 Secondary containment coatings.

.3 Other special conditions as applicable.

.4 If products being used are manufactured by Company other than listed in the MATERIALS Article of this Specification Section, provide complete individual data sheet comparison of proposed products with specified products including:

.1 Application procedure.

.2 Coverage rates.

.3 Certification that product is designed for intended use and is equal or superior to specified product.

.5 Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.

.6 Coating manufacturer's recommendation on abrasive blasting.

.7 Coating manufacturer's technical representative's written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.

.8 Manufacturer's recommendation for universal barrier coat.

.9 Manufacturer's recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.

.2 Manufacturer's statement regarding applicator instruction on product use.

.4 Samples:

.1 Manufacturer's full line of colors for Engineer's preliminary color selection.

.5 Informational Submittals:

.1 Approval of application equipment.

.2 Applicator's daily records:

.1 Submit daily records at end of each week in which coating work is performed unless requested otherwise by Engineer's on-site representative.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver in original containers, labeled as follows:

.1 Name or type number of material.

.2 Manufacturer's name and item stock number.

.3 Contents, by volume, of major constituents.

.4 Warning labels.

.5 VOC content.

.2 Store materials in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 DEGF.

1.6 PROJECT CONDITIONS

.1 Pre-application Conference:

.1 Prior to commencement of surface preparation or coating application, the Contractor shall convene a pre-application conference with all affected parties, including but not limited to: the applicator, coating manufacturer's technical representative, Owner's representative, and Engineer's representative(s).

.2 The meeting shall discuss all aspects of the Project including but not limited to:

.1 Schedule.

.2 Material storage and handling.

.3 Examination of surfaces to be coated.

.4 Protection of surfaces not to be coated.

.5 Surface preparation.

.6 Coating application:

.1 Environmental conditions for application of coatings.

.2 Temporary environmental controls.

.7 Field quality control requirements:

.1 Manufacturer's technical representative responsibilities.

.2 Contractor performed testing.

.1 Instrumentation requirements.

.2 Frequency of testing.

.3 Record keeping.

.3 NACE inspector performed testing.

.2 Verify that atmosphere in area where coating is to take place is within coating manufacturer's acceptable temperature, humidity and sun exposure limits.

.1 Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.

.1 Provide temporary dehumidification equipment properly sized to maintain humidity levels required by coating manufacturer.

.2 Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 HR basis.

.1 Vent exhaust gases to outdoor environment.

.2 No exhaust gases shall be allowed to vent into the space being coated or any adjacent space.

.2 Do not apply coatings in snow, rain, fog or mist.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 High Performance Industrial Coatings:

.1 Carboline Protective Coatings.

.2 PPG.

.3 The Sherwin-Williams Company.

.4 Tnemec.

.5 AkzoNobel.

.2 Submit request for substitution in accordance with Specification Section 01 25 00.

.3 "Or-Equal" Submittals:

.1 Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the manufacturers listed.

.2 Provide satisfactory documentation from the proposed "or-equal" manufacturer that proposed materials meets or exceeds the following:

.1 Is of the same generic resin.

.2 Requires comparable surface preparation.

.3 Has comparable application requirements.

.4 Meets the same VOC levels or better.

.5 Provides the same finish and color options.

.6 Is suitable for the intended service.

.7 Resistance to abrasion and physical damage.

.8 Resistance to chemical attack.

.9 Resistance to UV exposure.

.10 Ability to recoat in future.

.11 Dry film thickness per coat.

.1 Where manufacturer’s product data sheet indicates a minimum MIL thickness per coat that is greater than specified herein, MIL thickness for entire coating system shall be increased proportionately.

.12 Minimum and Maximum time between coats.

.13 Compatibility with other coatings.

.14 Temperature limitations in service and during application.

.15 Type and quality of recommended undercoats and topcoats.

.16 Ease of application.

.17 Ease of repairing damaged areas.

.18 Stability of colors.

.3 The cost of all testing and analyzing of the proposed substitute materials shall be borne by the CONTRACTOR.

2.2 MATERIALS

.1 High Performance Industrial Coatings:

COATING CODE	GENERIC DESCRIPTION	MANUFACTURER	
		TNEMEC	SHERWIN WILLIAMS
AAE	Acrylic/Acrylate Emulsion	Series 180 WB Tneme-Crete	Cement Plex 875
AREC	Abrasion-Resistant Epoxy Coating	Series 435 Perma-Glaze	Duraplate 5900
CRM	Cementitious Repair Mortar	Series 217 MortarCrete	Cemtec Silatec MSM
CRU	Corrosion Resistant Urethane	Series 290 CRU	Polylon HP
DFA	Dry-fall Acrylic	Series 115 Uni-Bond DF	DFA Dry Fall Acrylic
EBF	Epoxy Block Filler	Series 1254 Epoxoblock WB	Kem Cati Coat HS
ESF	Epoxy Surfacer/Filler	Series 215 Surfacing Epoxy	Steel Seam FT 910
EMM	Epoxy Modified Cementitious Mortar	Series 218 MortarClad	Duraplate 2300
EF	Epoxy Flooring	Series 237 Power-Tread	GP3746
GFRE	Glass Flake Reinforced Epoxy	Series 142	Sher-Glass FF
HREM	H2S-Resistant Epoxy Mortar	Series 434 Perma-Shield H_2S	Duraplate 5900 Mortar
HU	Hybrid Urethane	Series 740 UVX	Acrolon Ultra
MIO	MIO Polyurethane	Series 1 Omnithane	Corothane 1 MIO
MPE	Multi-Purpose Epoxy	Series N69 Hi-Build Epoxoline II	Macropoxy 646
MTEP	Moisture-Tolerant Epoxy Primer	Series 201 Epoxoprime	Corobond 100
SCE	Secondary Containment Epoxy	Series 237SC Chembloc	Cor Cote HP

COATING CODE	GENERIC DESCRIPTION	MANUFACTURER	
		TNEMEC	SHERWIN WILLIAMS
SCEP	Secondary Containment Epoxy Primer	Series 206SC Chembloc	GP3552
STEP	Surface-Tolerant Epoxy Primer	Series 135 Chembuild	Macropoxy 646
UHSE	Ultra-High Solids Epoxy (NSF 61)	Series 22 Epoxoline	Duraplate UHS
VEP	Vinyl Ester Primer	Series 251SC Chembloc	Corobond Vinyl Ester Primer
VESC	Vinyl Ester Secondary Containment	Series 252SC Chembloc	Cor Cote VEN FF
ZRU	Zinc-Rich Urethane	Series 94-H_20 Hydro-Zinc	Corothane 1 Galvapak

2.3 COATING SYSTEMS:

.1 The following tables indicate coating systems by material and environment, unless a specific application is indicated.

Environment/ Application	Surface Preparation	Prime Coat	Intermediate Coats	Finish Coat
Ferrous Metals (Structural & Miscellaneous Metals)				
Interior atmospheric	SSPC-SP 6/ NACE No. 3	3.0 to 4.0 MIL MPE	3.0 to 4.0 MIL MPE	3.0 to 4.0 MIL MPE
Outdoor atmospheric	SSPC-SP 6/ NACE No. 3	2.5 to 3.5 MIL ZRU	3.0 to 5.0 MIL MPE	2.5 to 3.5 MIL HU
Outdoor atmospheric	SSPC-SP 6/ NACE No. 3	3.0 to 4.0 MIL MPE	3.0 to 4.0 MIL MPE	2.5 to 3.5 MIL HU
Galvanized Steel				
Interior atmospheric	SSPC-SP 16	4.0 to 6.0 MIL STEP		2.0 to 3.0 MIL MPE
Immersion - non NSF	SSPC-SP 16	4.0 to 6.0 MIL STEP	2.0 to 3.0 MIL MPE	2.0 to 3.0 MIL MPE
Outdoor atmospheric	SSPC-SP 16	4.0 to 6.0 MIL STEP		2.5 to 3.5 MIL HU
Field cut pipe threads	SSPC-SP 3	4.0 to 6.0 MIL STEP	Coat per exposure above	Coat per exposure above
Non Ferrous Metals, including piping				

Environment/ Application	Surface Preparation	Prime Coat	Intermediate Coats	Finish Coat
Dissimilar Materials Protection	SSPC-SP 2	4.5 to 5.5 MIL MPE		
Interior atmospheric	SSPC-SP 2	3.0 to 4.0 MIL MPE		3.0 to 4.0 MIL MPE
Outdoor atmospheric	SSPC-SP 2	4.0 to 6.0 MIL MPE		2.5 to 3.5 MIL HU
Ferrous Piping				
Interior atmospheric	SSPC-SP 6/ NACE No. 3	2.5 to 3.5 MIL ZRU	3.0 to 4.0 MIL MPE	3.0 to 4.0 MIL MPE
Outdoor atmospheric	SSPC-SP 10/ NACE No. 2	2.5 to 3.5 MIL ZRU	3.0 to 4.0 MIL MPE	2.5 to 3.5 MIL HU

3. EXECUTION

3.1 ITEMS TO BE COATED

.1 Interior Areas:

.1 Do not coat piping scheduled to be insulated.

.2 Miscellaneous galvanized steel surfaces:

.1 Contractor designed staircases.

.2 Items specifically noted on Drawings to be coated.

.3 Safety Striping:

.1 Equipment Pads: Coat vertical face and return 75mm onto horizontal surface of pad.

.2 Pipe supports, columns, piers and similar vertical elements.

.3 As shown on Drawings.

3.2 ITEMS NOT TO BE COATED

.1 General: Do not coat items listed in this Article, unless noted otherwise.

.2 Items with Approved Factory Finish: These items may require repair of damaged coated areas or coating of welded connections.

.3 Electrical Equipment.

.4 Moving parts of mechanical and electrical units where coating would interfere with the operation of the unit.

.5 Code labels, equipment identification or rating plates and similar labels, tagging and identification.

.6 Contact surfaces of friction-type structural connections.

.7 Stainless Steel Surfaces, except:

.1 Dissimilar metals in immersion service.

.2 Piping where specifically noted to be coated.

.3 Banding as required to identify piping.

.8 Aluminum Surfaces, except:

.1 Where specifically shown in the Contract Documents.

.2 Where in contact with concrete.

.3 Where in contact with dissimilar metals.

.4 Appurtenant surfaces as described in the ITEMS TO BE COATED article.

.9 Mechanical piping scheduled to be insulated.

.10 Interior of Pipe, Ductwork, and Conduits.

.11 Galvanized Steel Items, unless specifically noted to be coated.

3.3 PREPARATION

.1 General:

.1 Prepare surfaces to be coated in accordance with coating manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.

.1 Where discrepancy between coating manufacturer's instructions and this Specification Section exists, the more stringent surface preparation shall be provided unless approved otherwise, in writing, by the Engineer.

.2 Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.

.3 Adhere to manufacturer's recoat time surface preparation requirements.

.1 Surfaces that have exceeded coating manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional coating in accordance with manufacturer's published recommendations.

.1 Minimum SSPC-SP 7/ NACE No. 4 unless otherwise approved by Engineer.

.2 Protection:

.1 Protect surrounding surfaces not to be coated.

.2 Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

.3 Protect code labels, equipment identification or rating plates and similar labels, tagging and identification.

.3 Prepare and coat before assembly all surfaces which are inaccessible after assembly.

.4 Ferrous Metal:

.1 Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAPF.

.1 All piping, pumps, valves, fittings and any other component used in the water piping system that requires preparation for coating shall be prepared in accordance with requirements for immersion service.

.2 Prepare all areas requiring patch coating in accordance with recommendations of manufacturer and NAPF.

.3 Remove bituminous coating per piping manufacturer, coating manufacturer and NAPF recommendations.

.1 The most stringent recommendations shall apply.

.2 Complete fabrication, welding or burning before beginning surface preparation.

.1 Chip or grind off flux, spatter, slag or other laminations left from welding.

.2 Remove mill scale.

.3 Grind smooth rough welds and other sharp projections.

.3 Solvent clean in accordance with SSPC-SP 1.

.4 Restore surface of field welds and adjacent areas to original surface preparation.

.5 Galvanized Steel and Non-ferrous Metals:

.1 Solvent clean in accordance with SSPC-SP 1 followed by brush-off blast clean in accordance with SSPC-SP 16 to remove zinc oxide and other foreign contaminants.

.1 Provide uniform 1 MIL profile surface.

.6 Preparation by Abrasive Blasting:

.1 Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before coating.

.2 Provide compressed air for blasting that is free of water and oil.

.1 Provide accessible separators and traps.

.3 Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.

.4 All abrasive-blasted ferrous metal surfaces shall be inspected immediately prior to application of coatings.

.1 Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with these Specifications.

.5 Perform additional blasting and cleaning as required to achieve surface preparation required.

.1 Re-blast surfaces not meeting requirements of these Specifications.

.2 Prior to coating, re-blast surfaces allowed to set overnight and surfaces that show rust bloom.

.3 Surfaces allowed to set overnight or surfaces which show rust bloom prior to coating shall be re-inspected prior to coating application.

.6 Profile depth of blasted surface: Not less than 1 MIL or greater than 2 MILS unless required otherwise by coating manufacturer.

.7 Ensure abrasive blasting operation does not result in embedment of abrasive particles in coating.

.8 Confine blast abrasives to area being blasted.

.1 Provide shields of polyethylene sheeting or other such barriers to confine blast material.

.2 Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.

.9 Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.

.10 Properly dispose of blasting material contaminated with debris from blasting operation.

3.4 APPLICATION

.1 General:

.1 Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.

.1 Application equipment must be inspected and approved in writing by coating manufacturer.

.2 Temperature and weather conditions:

.1 Do not coat surfaces when surface temperature is below 50 DEGF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and coating manufacturer's technical representative.

.2 Avoid coating surfaces exposed to hot sun.

.3 Do not coat damp surfaces.

.4 Apply coating to concrete or masonry surfaces in descending temperatures, in accordance with coating manufacturer's application instructions.

.3 Apply materials under adequate illumination.

.4 Provide complete coverage to MIL thickness specified.

.1 Thickness specified is dry MIL thickness.

.5 Evenly spread to provide full, smooth coverage.

.1 All coating systems are "to cover."

.1 In situations of discrepancy between manufacturer's square footage coverage rates and MIL thickness, MIL thickness requirements govern.

.2 When color or undercoats show through, apply additional coats until coating is of uniform finish and color.

.3 Finished coating system shall be uniform and without voids, bugholes, holidays, laps, brush marks, roller marks, runs, sags or other imperfections.

.6 If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.

.7 Work each application of material into corners, crevices, joints, and other difficult to work areas.

.8 Provide coating manufacturer's recommended details at all terminations, penetrations, embedments, cracks, joints and changes in substrate direction.

.9 Avoid degradation and contamination of blasted surfaces and avoid inter-coat contamination.

.1 Clean contaminated surfaces before applying next coat.

.2 Intercoat surface cleanliness shall be inspected and approved by the Engineer prior to application of each coat.

.10 Smooth out runs or sags immediately, or remove and recoat entire surface.

.11 Allow preceding coats to dry before recoating.

.1 Recoat within time limits specified by coating manufacturer.

.2 If recoat time limits have expired re-prepare surface in accordance with coating manufacturer's printed recommendations.

.12 Allow coated surfaces to cure prior to allowing traffic or other work to proceed.

.13 Coat all aluminum in contact with dissimilar materials.

.14 When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses provided that the maximum DFT is not exceeded.

.15 Backroll surfaces if coatings are spray applied.

.2 Employ services of coating manufacturer's technical representative to ensure that field-applied coatings are compatible with factory-applied or existing coatings.

.1 Certify through material data sheets.

.2 Perform test patch.

.1 Prepare existing coating surface to receive specified coating system.

.2 Apply coating to a minimum 1 SQFT area and allow to cure in accordance with manufacturer's recommendations.

.3 Evaluate adhesion to existing coating:

.1 Concrete or Masonry substrates: ASTM D4541.

.2 All other substrates: ASTM D6677 and ASTM D3359 (X-cut method).

.3 If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.

.1 Perform test patch as described above.

.4 At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate coating system listed in the MATERIALS Article, Coating Systems paragraph of this Specification Section.

.1 All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.

.3 Prime Coat Application:

.1 Apply structural steel and miscellaneous steel prime coat in the factory.
  .1 Finish coats shall be applied in the field
  .2 Prime coat referred to here is prime coat as indicated in this Specification.
    .1 Prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.
.2 Prime all surfaces indicated to be coated.
  .1 Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Specification Section.
.3 Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
.4 Apply zinc-rich primers while under continuous agitation.
.5 Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
.6 Touch up damaged primer coats prior to applying finish coats.
  .1 Restore primed surface equal to surface before damage.
.7 All surfaces of steel lintels and steel components of concrete lintels used in wall construction shall be completely coated with both prime and finish coats prior to placing in wall.

.4 Finish Coat Application:
  .1 Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Specification Section; manufacturer instructions take precedent over these Specifications.
  .2 Touch up damaged finish coats using same application method and same material specified for finish coat.
    .1 Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.

3.5 COLOR CODING

.1 Color code piping in accordance with the SCHEDULE Article of this Specification Section.

3.6 FIELD QUALITY CONTROL

.1 Application Deficiencies:
  .1 Surfaces showing runs, laps, brush marks, telegraphing of surface imperfections or other defects will not be accepted.
  .2 Surfaces showing evidence of fading, chalking, blistering, delamination or other defects due to improper surface preparation, environmental controls or application will not be accepted.
    .1 Epoxy surfaces showing evidence of chalking or amine blush shall be prepared and recoated as follows:

.1 Solvent clean surfaces in accordance with SSPC-SP1 and abrasive blast in accordance with SSPC-SP7/ NACE No. 4.

.2 Recoat with intermediate and finish coats in accordance with coating system specified herein.

.2 Provide protection for coated surfaces.

.1 Surfaces showing soiling, staining, streaking, chipping, scratches, or other defects will not be accepted.

.3 Contractor Performed Testing:

.1 Provide ongoing testing and inspection, including but not limited to the following:

.1 Measurement and recording of environmental conditions as specified herein.

.2 Measurement and recording of substrate conditions as specified herein.

.3 Thickness Testing:

.1 Wet film thickness during application in accordance with ASTM D4414.

.2 Dry Film Thickness (DFT) in accordance with SSPC-PA 2.

.3 Engineer may measure coating thickness at any time during project to assure conformance with these Specifications.

.4 NACE inspection:

.1 The Owner reserves the right to retain a NACE Level 3 coating inspector to perform observation, inspection and testing as deemed necessary to document the quality of the Work.

.1 All work shall be done to the satisfaction of the Owner's inspector.

.2 Any portion of the coating that does not satisfactorily pass the inspection and testing requirements shall be repaired or replaced by the Contractor at no additional cost to the Owner.

.3 Additional testing and/or inspection may be done at the discretion of the Owner.

.1 The Contractor will provide all equipment, materials, and labor to perform the testing.

.2 Inspection, testing or observation by the Owner's inspector shall not relieve the Contractor of responsibility for surface preparation, inspection or quality control specified herein.

.5 Instrumentation:

.1 Provide instrumentation as necessary to measure and record atmospheric and substrate conditions, including but not limited to:

.1 Dry Film Thickness Gauge:

.1 Ultrasonic: ASTM D6132.

.2 Magnetic: ASTM B499.

.2 Wet Film Thickness Gauge: ASTM D4414.

.3 Sling Psychrometer: ASTM E337.

.4 Surface Temperature Gauge.
.5 Anemometer.
.6 Moisture Meter.
.7 Adhesion test apparatus:
.1 Steel: ASTM D4541.
.2 Concrete: ASTM D7234.

.6 Maintain Daily Records:
.1 Record the following information during application:
.1 Date, starting time, end time, and all breaks taken by applicators.
.2 Air temperature.
.3 Relative humidity.
.4 Dew point.
.5 Moisture content and pH level of concrete or masonry substrates prior to coating.
.6 Surface temperature of substrate.
.7 Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate wind-blown dust and debris from contaminating the wet coating.
.8 For outdoor coating, also record:
.1 Sky condition.
.2 Wind speed and direction.
.9 Record environmental conditions, substrate moisture content and surface temperature information not less than once every 4 HRS during application.
.1 Record hourly when temperatures are below 50 DEGF or above 100 DEGF.
.2 Record the following information daily for the coating manufacturer's recommended curing period:
.1 Date and start time of cure period for each item or area.
.2 For outdoor coating, also record:
.1 Sky conditions.
.2 Wind speed and direction.
.3 Air temperature.
.1 Dry Bulb.
.2 Wet Bulb.
.4 Relative humidity.
.5 Dew point.
.6 Surface temperatures.
.3 Record environmental conditions not less than once every 4 HRS.

.1 Record hourly when temperatures are below 50 DEGF or above 100 DEGF.

.4 Provisions utilized to protect each item or area and to maintain areas within manufacturer's recommended curing parameters.

.3 Format for daily record to be computer generated.

.7 Provide wet paint signs.

3.7 CLEANING

.1 Clean coating spattered surfaces.

.1 Use care not to damage finished surfaces.

.2 Upon completion of coating, replace hardware, accessories, plates, fixtures, and similar items.

.3 Remove surplus materials, scaffolding, and debris.

3.8 COLOR SCHEDULE

.1 Pipe Bollards: Safety Yellow.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Tag, tape and stenciling systems for rooms, process equipment, process piping, process valves, pumps, and similar items not included in Related Sections.

.2 Hazard and safety signs.

.2 Related Specification Sections include but are not necessarily limited to:

.1 26 05 00 Common Work Results for Electrical

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Society of Mechanical Engineers (ASME):

.1 A13.1, Scheme for the Identification of Piping Systems.

.2 The International Society of Automation (ISA).

.3 National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):

.1 Z535.1, Safety Colour Code.

.2 Z535.2, Environmental and Facility Safety Signs.

.3 Z535.3, Criteria for Safety Symbols.

.4 Z535.4, Product Safety Signs and Labels.

.4 National Fire Protection Association (NFPA):

.1 70, National Electrical Code (NEC).

.2 704, Standard System for the Identification of Hazards of Materials for Emergency Response.

.5 Canadian Standards Association (CSA):

.1 CAN/CSA-Z321 Signage and Symbols for the Workplace

.2 CAN/CSA-24.3 – Identification of Piping Systems

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data including:

.1 Catalog information for all identification systems.

.2 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and colour.

.3 Schedule of Hazard and Safety Signage indicating text and graphics.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 W.H. Brady Co.

.2 Panduit.

.3 Seton.

.4 National Band and Tag Co.

.5 Carlton Industries, Inc.

2.2 MANUFACTURED UNITS

.1 Type A1 - Round Metal Tags:

.1 Materials:

.1 Aluminum

.Size:

.2 Diameter: 1-1/2 inches minimum.

.3 Thickness: 0.035 inches 20 GA minimum.

.2 Fabrication:

.1 3/16 inches minimum mounting hole.

.2 Legend: Stamped and filled with black colouring.

.3 Colour: Natural.

.2 Type A2 - Rectangle Metal Tags:

.1 Materials: Stainless steel.

.2 Size:

.1 3-1/2 inches x 1-1/2 inches minimum.

.2 Thickness: 0.036 inches (20 GA) minimum.

.3 Fabrication:

.1 3/16 inches minimum mounting hole.

.2 Legend: Stamped and filled with black colouring.

.4 Colour: Natural.

.3 Type A3 - Metal Tape Tags:

.1 Materials: Aluminum or stainless steel.

.2 Size:

.1 Width 1/2 inches minimum.

.2 Length as required by text.

.3 Fabrication:

.1 3/16 inches minimum mounting hole.

.2 Legend: Embossed.

.4 Colour: Natural.

.4 Type B1- Square Nonmetallic Tags:

.1 Materials: Fiberglass reinforced plastic.

.2 Size:

.1 Surface: 2 x 2 inches minimum.

.2 Thickness: 100 mils.

.3 Fabrication:

.1 3/16 inches mounting hole with metal eyelet.

.2 Legend: Preprinted and permanently embedded and fade resistant.

.4 Colour:

.1 Background: Manufacturer standard or as specified.

.2 Lettering: Black.

.5 Type B2 - Nonmetallic Signs:

.1 Materials: Fiberglass reinforced or durable plastic.

.2 Size:

.1 Surface: As required by text.

.2 Thickness: 60 mils minimum.

.3 Fabrication:

.1 Rounded corners.

.2 Drilled holes in corners with grommets.

.3 Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.

.4 Colour:

.1 Background: Manufacturer standard or CSA standard.

.2 Lettering: Black.

.6 Type C - Laminated Name Plates:

.1 Materials: Phenolic or DR (high impact) acrylic (Lamacoid).

.2 Size:

.1 Surface: As required by text.

.2 Thickness: 1/16 inches.

.3 Fabrication:

.1 Outdoor rated and UV resistant when installed outdoors.

.2 Two layers laminated.

.3 Legend: Engraved through top lamination into bottom lamination.

.4 Two drilled side holes, for screw mounting.

.4 Colour: Black top surface, white core, unless otherwise indicated.

.7 Type D - Self-Adhesive Tape Tags and Signs:

.1 Materials: Vinyl tape or vinyl cloth.

.2 Size:

.1 Surface: As required by text.

.2 Thickness: 5 mils minimum.

.3 Fabrication:

.1 Indoor/Outdoor grade.

.2 Weather and UV resistant inks.

.3 Permanent adhesive.

.4 Legend: Preprinted.

.5 Wire markers to be self-laminating.

.4 Colour: White with black lettering or as specified.

.8 Type E - Heat Shrinkable Tape Tags:

.1 Materials: Polyolefin.

.2 Size: As required by text.

.3 Fabrication:

.1 Legend: Preprinted.

.4 Colour: White background, black printing.

.9 Type F - Underground Warning Tape:

.1 Materials: Polyethylene.

.2 Size:

.1 6 inches wide (minimum).

.2 Thickness: 3.5 mils.

.3 Fabrication:

.1 Legend: Preprinted and permanently imbedded.

.2 Message continuous printed.

.3 Tensile strength: 1750 psi.

.4 Colour: As specified.

.10 Type G - Stenciling System:

.1 Materials:

.1 Exterior type stenciling enamel.

.2 Either brushing grade or pressurized spray can form and grade.

.2 Size: As required.

.3 Fabrication:

.1 Legend: As required.

.4 Colour: Black or white for best contrast.

.11 Underground Tracer Wire:

.1 Materials:

.1 Wire:

.1 12 GA AWG.

.2 Solid.

.2 Wire nuts: Waterproof type.

.3 Split bolts: Brass.

2.3 ACCESSORIES

.1 Fasteners:

.1 Bead chain: #6 brass, aluminum or stainless steel.

.2 Plastic strap: Nylon, urethane or polypropylene.

.3 Screws: Self-tapping, stainless steel.

.4 Adhesive, solvent activated.

2.4 MAINTENANCE MATERIALS

.1 Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

3. EXECUTION

3.1 GENERAL INSTALLATION

.1 Install identification devices at specified locations.

.2 All identification devices to be printed by mechanical process, hand printing is not acceptable.

.3 Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.

.4 Attach tags with 1/8 inches round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.

.1 Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.

.5 Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.

.1 Several items of equipment mounted in housing to be individually tagged inside the compartment.

.6 Tracer Wire:

.1 Attach to pipe at a maximum of 10 feet intervals with tape or tie-wraps.

.2 Continuous pass from each valve box and above grade at each structure.

.3 Coil enough wire at each valve box to extend wire a foot above the ground surface.

.4 1,000 feet maximum spacing between valve boxes.

.5 If split bolts are used for splicing, wrap with electrical tape.

.6 If wire nuts are used for splicing, knot wire at each splice point leaving 6 inches of wire for splicing.

.7 Use continuous strand of wire between valve box where possible.

.1 Continuous length shall be no shorter than 100 feet.

3.2 SCHEDULES

.1 Hazardous Material Identification Signage:

.1 Tag Type: Type B2 - Nonmetallic Signs.

.2 Fastener: Screw or adhesive.

.3 Size (NFPA Diamond): Per NFPA 704, 10” minimum.

.4 Size (Hazardous Material name, with concentration % where applicable): 2 inches minimum letters, directly below corresponding NFPA Diamond.

.5 Location: Exterior Door.

.1 Allowance: Provide 1 for Caustic Soda Solution.

.6 Legend:

.1 UN214 Diamond Label

.2 Process Systems:

.1 General:

.1 Provide arrows and markers on piping.

.1 At 20 feet maximum centers along continuous lines.

.2 At changes in direction (route) or obstructions.

.3 At valves, risers, "T" joints, machinery or equipment.

.4 Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.

.2 Position markers on both sides of pipe with arrow markers pointing in flow direction.

.1 If flow is in both directions use double headed arrow markers.

.3 Apply tapes and stenciling in uniform manner parallel to piping.

.4 Systems to be labeled

.1 Caustic Soda Piping (CS)

.2 Caustic Side Stream (CSS)

.3 PW From Cheakamus Reservoir

.4 PW To/From Gondola Reservoir

.5 PW To Pressure Relief

.6 PW To Cheakamus

.5 Owner to coordination final label location on PW piping

.2 Trenches with piping:
  .1 Tag type: Type F - Underground Warning Tape
  .2 Location: Halfway between top of piping and finished grade.
  .3 Letter height: 1-1/4 inches minimum.
  .4 Potable water:
    .1 Colour: Blue with black letters.
    .2 Legend:
      .1 First line: "CAUTION CAUTION CAUTION"
      .2 Second line: "BURIED WATER LINE BELOW"
  .5 Storm and sanitary sewer lines:
    .1 Colour: Green with black letters.
    .2 Legend:
      .1 First line: "CAUTION CAUTION CAUTION"
      .2 Second line: "BURIED SEWER LINE BELOW"
  .6 Process water piping:
    .1 Colour: Green with black letters.
    .2 Legend:
      .1 First line: "CAUTION CAUTION CAUTION"
      .2 Second line: "BURIED NONPOTABLE WATER LINE BELOW"
.3 Valves and slide gates:
  .1 Tag type:
    .1 Outdoor locations: Type B1 - Square Nonmetallic Tags.
    .2 Indoor noncorrosive:
      .1 Type A1 - Round Metal Tags.
      .2 Type B1 - Square Nonmetallic Tags.
    .3 Indoor corrosive:
      .1 Stainless steel Type A1 - Round Metal Tags.
      .2 Type B1 - Square Nonmetallic Tags.
  .2 Fastener:
    .1 Type A1: Chain of the same material.
    .2 Type B1: Stainless steel chain.
  .3 Colour: Per ASME A13.1 corresponding to the piping system.
  .4 Legend:
    .1 Letter height: 1/4 inches minimum.
    .2 Valve designation as indicated on the Drawings (e.g., "V-xxx").
.4 Process equipment (e.g., pumps, pump motors, actuators, equipment, etc.):
  .1 Tag type:

.1 Type B2 - Nonmetallic Signs.
.2 Type D - Self-Adhesive Tape Tags and Signs.
.3 Type G - Stenciling System.

.2 Fastener:
.1 Self.
.2 Screws.
.3 Adhesive.

.3 Legend:
.1 Letter height: 1/2 inches minimum.
.2 Equipment designation as indicated on the Drawings (e.g., "Primary Pump P-xxx").

.5 Process Piping systems:
.1 Tag type:
.1 Outdoor locations: Type G - Stenciling System.
.2 Indoor locations:
.1 Type D - Self-Adhesive Tape Tags and Signs.
.2 Type G - Stenciling System.

.2 Fastener: Self.
.3 Colour: Per ASME A13.1.
.4 Legend:
.1 Letter height: Manufacturers standard for the pipe diameter.
.2 Mark piping in accordance with ASME A13.1.
.3 Use piping designation as indicated on the Drawings.
.4 Arrow: Single arrow.

.6 Process tanks (over 1000 GAL) (e.g.: caustic tanks):
.1 Tag type:
.1 Type B2 - Nonmetallic Signs.
.2 Type G - Stenciling System.

.2 Fastener:
.1 Screw.
.2 Self.

.3 Location as directed by Owner.
.4 Legend:
.1 Letter height: 4 inches minimum.
.2 Equipment designation as indicated on the Drawings (e.g., "Tank T-xxx").

.7 Process Tanks (less than 1000 GAL) (e.g., softener, hot-water tanks, etc.):
.1 Tag type:

.1 Type D - Self-Adhesive Tape Tags and Signs.
.2 Type G - Stenciling System.
.2 Fastener: Self.
.3 Legend:
.1 Letter height: 2 inches minimum.
.2 Equipment designation as indicated on the Drawings

.3 Instrumentation Systems:
.1 Instrumentation Equipment (e.g., flow control valves, primary elements, etc.):
.1 Tag type:
.1 Outdoor locations: Type B1 - Square Nonmetallic Tags.
.2 Indoor noncorrosive:
.1 Type A1 - Round Metal Tags.
.2 Type B1 - Square Nonmetallic Tags.
.3 Indoor corrosive:
.1 Stainless steel Type A1 - Round Metal Tags.
.2 Type B1 - Square Nonmetallic Tags.
.2 Fastener:
.1 Type A1: Chain of the same material.
.2 Type B1: Stainless steel chain.
.3 Legend:
.1 Letter height: 1/4 inches minimum.
.2 Equipment ISA designation as indicated on the Drawings (e.g., “FIT-xxx”).
.2 Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):
.1 Tag type: Type C - Phenolic Name Plates.
.2 Fastener: Screws.
.3 Legend:
.1 Letter height: 1/2 inches minimum.
.2 Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").
.3 Components inside equipment enclosure, (e.g., PLC’s, control relays, contactors, and timers):
.1 Tag type: Type D - Self-Adhesive Tape Tags.
.2 Fastener: Self.
.3 Legend:
.1 Letter height: 3/16 inches minimum.
.2 Description or function of component (e.g., "PLC-xxx” or “CR-xxx").
.4 Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):

.1 Tag type: Type C - Phenolic Name Plates.
.2 Fastener: Screws.
.3 Legend:
.1 Letter height: 1/4 inches minimum.
.2 Component ISA tag number as indicated on the Drawings (e.g., “HS-xxx”).

.4 Rooms
.1 Door Plates
.1 Tag type: Type C - Phenolic Name Plates.
.2 Fastener: Adhesive.
.3 Legend:
.1 Letter height: 1/4 inches minimum.
.2 Component tag number as indicated on the Drawings or as defined by contractor (e.g., “ROOM-xxx”).

END OF SECTION

SECTION 12 35 53
METAL CASEWORK

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Metal Cabinet

1.2 QUALITY ASSURANCE

.1 Qualifications:
- .1 Manufacturer qualifications:
  - .1 Minimum 10 years' experience.
  - .2 Five similar installations in past two years.
  - .3 Content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Product numbers based on Hallowell Cabinets from Grainger Canada.
- .1 Hallowell HW4SC8478-4CL

2.2 MATERIALS

.1 Metal: 14-gauge

.2 .Metal Cabinet
- .1 48" x 24" x 78" in size
- .2 4 Shelves Minimum

3. EXECUTION

3.1 PROTECTION

.1 Cover work surfaces as recommended by manufacturer.
- .1 Protect all installed casework and accessories per manufacturer instructions.

.2 Remove protection upon acceptance of Project by Owner.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Brine Regenerated Water Softening Systems.

.2 Vertical, pressure type ion exchange softening filters, with all supports, accessories, appurtenances, and media, filter, and support media as specified herein.

.3 Top mounted automatic control systems to be included with the tanks and suitable for timer control and automated operation.

.2 Related Sections:

.1 01 33 00 – Submittal Requirements

.2 22 05 90 – Plumbing Specialties

1.2 QUALITY ASSURANCE

.1 Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

.1 Alberta Plumbing Code

.2 ASME compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code

.3 National Sanitation Foundation NSF/ANSI-61 (potable drinking water) and NSF-61 Annex G (listed as ≤ 0.25% weighted average lead content) (and/or NSF/ANSI-372) and Annex F.

.2 Qualifications:

.1 Manufacturer's experience:

.1 Minimum of 10 years experience designing and manufacturing water softening systems similar to the type to be used for this project.

.2 Minimum of five similar facilities operating for at least two years.

.3 Contractor may be required to submit evidence to this effect together with a representative list of installations.

.3 System Responsibility:

.1 Filter supplier shall be responsible for furnishing, coordinating, and overseeing assembly, installation, testing, and starting the softening filter system.

.4 Performance Guarantee:

.1 Provide a complete parts and labour warranty for a minimum of one year from the date of Substantial Completion.

.2 Control valve, media tank and brine tanks warranty to be five (5) years from the date of Substantial Completion.

.5 System Description:

.1 Two brine regenerated filters will be used to remove calcium and magnesium from water that has supplied from a local ground water well. The system shall include the necessary appurtenances including valves, gauges, control heads, brine tanks and be supplied and assembled by a single vendor.

.2 The system shall utilize a single (1) brine tank shared between the two filters.

.3 Downstream operating pressure will be between 50 and 70 psi. The upstream system will be controlled using a pressure reducing valve.

.4 Normal operational flow through the system will be controlled from a downstream Flow Control Valve. Backwashing, regeneration and rinse to waste flow will not be subject to the control from the downstream Flow Control Valve.

.5 PLC Operation will permit or prevent backwash/rengeration.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Water softening system and accessories including rated capacities, operating characteristics, furnished specialties, accessories, dimensions of individual components and profiles.

.2 Construction details and piping diagrams of water softening system and components.

.3 Wiring diagrams for power, signal, control wiring and monitoring points tied into the owners building monitoring system.

.4 Proof of NSF 61 compliance for softeners used for drinking water systems.

.2 Operations and Maintenance Manuals:

.1 See Specification Section 01 78 39 for requirements for:

.1 The mechanics and administration of the submittal process.

.2 The content of Operation and Maintenance Manuals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable Manufacturers:

.1 Filterco Water Treatment Ltd.

.2 Watertiger Purification Systems

.3 Aslan Technologies

2.2 WATER SOFTENER

.1 Provide a factory assembled, pressure type packaged water softener, consisting of a softener tank, valve, brine tank (including first full fill of the brine tank), etc., all as required for a complete system. Constructed to handle up to 15 degrees Celsius water.

.2 When used for drinking water systems, water softening system shall comply with NSF 61, “Drinking Water System Components – Health Effects”

2.3 PERFORMANCE

.1 Provide a water softening systems that delivers the output water quality, capacity, and performance indicated below at the specified water input characteristics indicated.

.2 Input water characteristics:

.1 Raw water quality is generally as follows:

Parameter	Value
Hardness	45 mg/L
Alkalinity	33 mg/L
Magnesium	2 mg/L
Calcium	14 mg/L
Manganese	0.06 mg/L
Iron	0.077 mg/L
Sodium	31 mg/L
Potassium	3 mg/L
Sulfate	12 mg/L
Chloride	42 mg/L

.3 Output capacity and performance:

.1 Duplex resin tanks to provide continuous operation.

.2 Minimum Control valve pipe size 50mm (2").

.3 Design flow rate:50 GPM

.4 Peak flow rate 95 GPM @ a maximum 25 psi pressure drop.

.5 Maximum regeneration time: 90 min

.6 Maximum of one regeneration per 36 hour period.

.7 Regenerations between brine tank refills: 15

.8 Water quality output conditions in $CaCO_3$ equivalents:

.1 <1- ppm hardness

.9 Maximum waste to not exceed the pump capacity of 15 gpm.

.4 When used for drinking water systems, water softening system shall comply with NSF 61, “Drinking Water System Components – Health Effects”.

2.4 RESIN TANK

.1 Resin tank shall be designed for a maximum of100 psig, and be tested at 150 psig. Tanks shall be composite media type.

.1 Tank shall be equipped with an opening in the top head for media filling and periodic inspection.

.2 Tank to be provided with suitable strapping for anchorage to adjacent walls.

2.5 BRINE SYSTEM

.1 Brine system shall consist of combination salt storage brine tank. Tank shall be molded of corrosion-proof, high density polyethylene.

.2 Brine tank shall be equipped with an elevated salt plate for brine collection, and a chamber to house a brine valve assembly. The brine valve shall automatically open to admit brine to the resin tank during eduction and close automatically to prevent introduction of air into the resin tank. During refill, the brine valve shall regulate the flow of treated water into the brine tank, working with the timed refill feature of the control valve. Together these components shall admit the correct volume of water to the brine tank in accordance with the salt dosage settings on the control valve. The brine valve shall include a float operated safety shut-off valve as a backup to the timed refill valve on the controller to prevent brine tank overflow

2.6 DISTRIBUTOR SYSTEM

.1 Resin tank shall have a top mount distributor which shall disperse water laterally to avoid channeling within the resin bed.

2.7 SOFTENING MEDIA

.1 High-capacity ion-exchange resin that is stable over the entire pH range of the water being treated with good resistance to bead fracture from attrition or shock.

2.8 AUTOMATIC CONTROLS

.1 Automatic controls shall be of top mount design. Provide readily accessible service connections. Provide a fully automatic multi-port control valve operated by a rotary pilot that hydraulically or pneumatically activates cartridge style diaphragm valves to accomplish regeneration. The multi-port valve shall incorporate self-adjusting flow regulators to control the rate of flow and prevent resin loss during back-wash, brine rinse, and brine refill positions, regardless of pressure fluctuations between 30 and 100 psig. The electrical control mechanism shall be enclosed in a gasketed, moisture-and corrosion resistant case. The enclosure shall conform to NEMA 3 enclosure standards.

.2 Control head and multifunction valve shall be Pentair 2900NXT2 configured for remote start control.

2.9 AUXILIARY EQUIPMENT

.1 Provide pressure gauge on inlet and outlet of softener.

.2 Provide test cock to sample water in and soft water out.

.3 Communication cables

2.10 BRINE

.1 High-purity sodium chloride, free of dirt and foreign material. Processed, food grade salt pellets, 99% pure. Rock and granulated forms are not acceptable.

3. EXECUTION

3.1 INSTALLATION

.1 Complete installation shall be in accordance with manufacturer's instruction and recommendations. Contractor shall be responsible for receiving all equipment, placing and assembling of all components for a complete and operational system.

.2 Install the equipment level on a concrete base sloped so that water will not stand under or around the equipment.

.3 Make all connections required. Provide rigid connections to softener input and output water connections, using approved joining methods. Hoses shall not be used.

.4 Install service valves to isolate the softener system input and output, and to provide a bypass path around the softener to allow softener servicing.

.5 Install brine tank overflow drain line, routed to a floor drain, terminated with an approved air gap. Use approved materials and secure drain line using approved hangers.

.6 For softeners used in drinking water systems, flush, clean, and disinfect per Related Section and manufacturer's instructions.

3.2 CHECK, TEST & START-UP

.1 Check, test and start-up services shall be provided by a factory trained representative as follows:

.1 Inspect the equipment to verify proper installation.

.2 Set-up the controller and place the equipment into operation.

.3 Test to verify all performance.

.2 The manufacturer representative's shall provide a written report within 3 days of the Check, Test, Start-up. Report shall include information on services provided, document all controller settings, and indicate the results of the water quality performance tests.

3.3 TRAINING

.1 Factory trained representative shall provide training to owner maintenance staff on the control and operation of the softening equipment and accessories. This shall include adjusting controller settings, cleaning of eductor and filters, other general maintenance procedures, and rebuilding the control valve head. Provide a spare control valve head to demonstrate rebuilding.

3.4 COMMISSIONING

.1 Perform the commissioning activities as outlined in the Division 01 Section Commissioning and other requirements of the Contract Documents.

END OF SECTION

1. GENERAL

1.1 REFERENCE DOCUMENTS

.1 Canadian Standards Association (CSA):

.2 Use the latest edition of the applicable codes, standards, and regulations.

.1 CAN/CSA-B45 Series-02 (R2008), Plumbing Fixtures.

.2 BC Plumbing Code

.3 Plumbing fixtures shall meet or exceed CAN/CSA-B45 Series-02, Plumbing Fixtures

1.2 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Section 01 25 00 for requirements pertaining to product options and substitutions.

1.3 REGULATORY REQUIREMENTS

.1 Plumbing fixtures shall be approved by the authority having jurisdiction.

1.4 CERTIFICATIONS

.1 Plumbing fixtures shall be tested, certified and labelled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labelled, provide written approval by the authority having jurisdiction.

1.5 SOURCE OF SUPPLY

.1 Each of the following products shall be by a single manufacturer:

.1 Fixtures of the same type or group.

.2 Fittings of the same type.

1.6 COORDINATION

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2. PRODUCTS

2.1 PIPING

.1 Piping for potable water systems to be per the BC Plumbing Code.

.2 Piping for sanitary drainage systems shall be ABS or DWV per the BC Plumbing Code.

2.2 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Stainless Steel Table With Sink - (72” Long X 32” Deep)

.1 Height 30 inches:

.2 16 Gauge, 400 series stainless steel with welded construction for consistent metal gauge thickness throughout. Sound deadened between top and bottom hat channels with double sided tape.

.3 Minimum 6" high backsplash and 2" high left, right and front rims. Rims to be 1 to 1-1/2" wide.

.4 Shall come with a single integrated right side sink. Sink to be 12" wide and 6" deep from drainboard. Drain to be 1-1/2" diameter, located 3.25" from the rear of the sink and 6" from each side. Sink compartment cover to be provided.

.5 Solid undershelf to be located with 14" clearance above.

.6 Gusseted 1-5/8" Stainless steel legs and feet, adjustable up to 1 inch.

.7 Quantity: 1.

.8 Quest Metal Works or approved equal.

.4 Mop sinks:

.1 Moulded high-density composite basin, 76 mm (3") PVC drain body, with stainless steel dome strainer/lint basket, 76 mm (3") gasketed outlet. Size: 610 x 610 x 254 mm. Complete with Zurn Model Z1996-24-WG, with two 610 x 610 mm stainless steel panels wall guards, 20 gauge satin finish, 305 mm (12") high and complete with the following:

.1 Supply fitting:

.1 Fitting with built-in elevated vacuum breaker, indexed blade handles, escutcheons, union inlets, rigid spout with atmospheric vacuum breaker, pail hook, brace to wall, integral stop valves. Provide accessories to limit maximum flow rate to 8.35 l/minute at 413 kPa.

.2 Hose:

.1 16 mm (5/8") diameter x 762 mm (30") long hose with brass coupling hose bracket and rubber grip.

.3 Mop Hanger:

.1 610 mm x 76 mm (24" x 3") stainless steel mop hanger with three (3) wall hooks.

.4 Strainer:

.1 76 mm (3") diameter stainless steel dome strainer/lint basket with locking nut and neoprene gasket for push-on connections.

.5 Emergency Eyewash/Shower

.1 Combination Eyewash/Shower:

.1 Provide free standing combination emergency drench showers with a 32 mm tepid water supply, 32 mm outlet, 25 mm ball valve, 254mm diameter ABS plastic shower head, 283mm diameter stainless steel facewash bowl, 737 mm long pull rod and hand operated eye wash. Valve on Shower to remain open until manually closed. Piping to be schedule 40 galvanized steel with orange polyethylene pipe covers for high visibility and corrosion resistance.

.2 The emergency shower shall be a Guardian G1950, or approved equal, and shall be located as detailed on drawings.

.3 Provide thermostatic mixing valves to provide a tempered water supply to both the eye wash and the shower. Valve to be installed in a surface mounted stainless steel cabinet. Guardian model TMV G3800.

.4 Provide flow regulators to regulate shower flow rate to 20 GPM. Guardian model G6040.

.5 Provide flow switches to provide flow indication. Guardian model AP275-615.

.6 Hot Water Tanks

.1 Provided shall be two, minimum 208 liter (55 USG) hot water tanks. The tank shall be provided with two 4500 watt, 208V, three phase elements.

.2 The hot water tank shall be supplied with a temperature and pressure relief valve, drain valve and a drip pan with drain to floor. Hot water tank shall be located as detailed on drawings.

.3 Temperature and pressure relief valve is to be piped to the floor drain next to the hot water tank.

.4 The hot water tank shall be set for 60 degrees Celsius.

.5 Shall be a Bradford White model RE255T6, electric water heater or approved alternate from AO Smith or John Wood.

.7 Hot Water Expansion Tank

.1 Provided shall be a hot water expansion tank with a gross volume of 8 L (2.1 USG), butyl rubber diaphram, 25 mm (1") bottom connection, maximum working pressure of 1035 kPa (150 psig), maximum temperature of 93 °C (200 °F) and precharged to 276 kPa (40 psig).

.2 Shall be Elbi of America Model DXT-08.

.8 WATER HAMMER ARRESTERS

.1 Fit water supply to each fixture or group of fixtures with an air chamber. Provide air chambers same size as supply line or 20 mm minimum, and minimum 450 mm long.

.2 Install stainless steel bellows type water hammer arresters on water lines connected to solenoid valves , flush valves and to fixture or group of fixtures complete with accessible isolation valve.

.9 Dial Thermometers

.1 Each gauge connection shall be provided with a 15 mm lever operated isolating ball valve.

.2 Gauges shall have a minimum 80mm dial, 15 mm MNPT bottom connection of stainless steel or brass and a dual scale Fahrenheit and Celsius readings. Gauge range 0-100 C (32-200 F psi).

.3 Isolating valve and installation fittings shall be stainless steel and hex nipples, not close type, shall be utilized.

.4 Wika TI.31, NuovaFima TB8, ENFM 4120 approved

.10 Hose Bibb

.1 Provided shall be 20mm hose bibs complete with connection vacuum breaker having break-away set screw.

.2 Shall be Watts 8B, Conbraco 38-304-AS, or as approved.

.11 Exterior Wall Hydrant

.1 Exterior wall hydrant to be a concealed non-freeze key operated wall hydrant with nickel bronze box and door, chrome plated hydrant face, integral vacuum breaker, 20mm (3/4") hose connection, 20mm (3/4") female x 25mm (1") male pipe connection, all bronze head, seat casting and internal working parts, bronze wall casing, and loose key.

.2 Shally comply with ASME B1.20.7 and ASSE 1019-2004. UPC/IAMPO listed.

.3 Max. operating pressure 125 psi.

.4 Shall be Watts HY-725.

.12 Floor Drains and Drainage System

.1 General floor drains shall be Zurn ZN415B. 15 mm trap primer connections shall be provided where indicated on drawings. Backwater valves shall be provided.

.2 Floor drains in Chemical and Chlorine Rooms shall be Zurn ZN415B-AR-V. 15 mm trap primer connections shall be provided. Backwater valves shall be provided.

.3 Funnel floor drains shall be Zurn ZN415B-OF. 15 mm trap primer connections shall be provided where indicated on drawings. Backwater valves shall be provided.

.4 Floor drains where the piping is cast into the floor slab shall be Zurn ZN455B.

.5 Floor drain size shall match the piping upon which they are to be installed. Minimum 80 mm.

.6 Floor drain strainer sizes are indicated on drawings. Minimum size is 150 mm.

.7 Trap primers feeding one or two traps shall be Zurn Sani-Guard Z1022-XL. Primers shall have 15 mm pipe connections. A 2-outlet distribution unit shall be provided where indicated on drawings. Two repair kits shall be provided. Trap primers air gap fitting to be provided for all trap primers. Fitting to include 25mm air gap.

.8 Trap primers feeding three or more traps shall be Zurn Z1022-XL. Primers shall have 20 mm pipe connections. A 4-outlet distribution unit shall be provided. Two repair kits shall be provided. Trap primer air gap fittings to be provided for all trap primers. Fitting to include 25mm air gap.

.13 Cleanouts

.1 Floor cleanouts shall be Zurn ZXN-1612 or equal.

.2 Wall cleanouts shall be Dura-coated cast iron body, gas and watertight ABS tapered thread plug, and nickel bronze secured, smooth wall access cover and frame. Zurn Z1443 or equal.

.14 Washdown Hoses

.1 Washdown hoses to be provided where shown on the drawings.

.2 Length to be 30 m for each hose.

.3 Hose shall be 19mm diameter for light duty service.

.4 Yellow Commercial Water – A2406075 x 100-20" as available from New Line Hose and Fittings.

.5 Fitting to be quick acting male and female coupling (DGH7C) and Model N545-075 nozzle.

.6 Two hoses are to be provided.

2.3 FIXTURE BRASS AND ACCESSORIES

.1 Visible parts of fixture brass and accessories shall be heavily chrome plated.

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 INSTALLATION

.1 Water supply and drainage connections to equipment to be per BC Plumbing code.

.2 Confirm the exact location of all plumbing fixtures and trim prior to roughing-in.

.3 When installation is complete, check and test the operation of each fixture and fitting. Adjust or repair as required.

.4 Emergency Showers: Install so that the bottom of the shower head is approximately 2m (82") above the floor, and approximately 400mm (16") out from the wall. Wall mount the mixing valve approximately 1.5m (5') above the floor and adjacent the shower head. Set the valve temperature limit stop to 95°F. Ensure that the valve is open, and that all exposed piping is chrome plated or stainless steel.

.5 Emergency Eye Wash Fixtures: Drench shower to be installed in accordance with ANSI Z358.1 requirements and manufacturer's instructions.

.6 Mixing Valves For Emergency Fixtures: Wall mount mixing valves for emergency fixtures approximately 1.5m (5') above the floor in a surface mounted SS cabinet and secure in place. Check and confirm valve operation and the temperature of the tempered water supply. Identify each cabinet and hand three identified cabinet keys to the Consultant prior to Substantial Performance.

.7 Mop Service Basins: Set mop service basins on the floor over drain piping and connect to the roughed-in service. Install wall supply trim and any accessories specified.

.8 Install each fixture with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.9 Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers and escutcheons.

.10 Install hose and faucets and hose connections with vacuum breakers.

3.3 PROTECTION

.1 Protect fixtures against use and damage during construction.

3.4 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.1 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.2 Checks:

.1 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions

END OF SECTION

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Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
P2	September 22, 2023	Issued for Tender	WW	BW
P1	August 30, 2023	Issued for Final Review	WW	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.1 RELATED SECTIONS

.1 Technical Specification 26 05 02 Seismic Restraint

.2 Technical Specification 26 05 05 Electrical Demolition

.3 Technical Specification 26 05 10 Testing and Commissioning

.4 Technical Specification 26 05 20 Wire and Box Connectors (0-1000V)

.5 Technical Specification 26 05 21 Wires and Cables (0-1000V)

.6 Technical Specification 26 05 28 Grounding - Secondary

.7 Technical Specification 26 05 29 Hangers and Supports for Electrical Systems

.8 Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets

.9 Technical Specification 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

.10 Technical Specification 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings

.11 Technical Specification 26 05 36 Cable Trays for Electrical Systems

.12 Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts

.13 Technical Specification 26 05 80 Fractional Horsepower Motors

.14 Technical Specification 26 05 81 Motors 0.746 to 149kW

.15 Technical Specification 26 09 24 Lighting Control Devices – Low Voltage

.16 Technical Specification 26 12 16 01 Dry Type Transformers up to 600V Primary

.17 Technical Specification 26 24 05 Switchboard TVSS Protection

.18 Technical Specification 26 24 16 01 Panelboards Breaker Type

.19 Technical Specification 26 24 19 Motor Control Centres

.20 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

.21 Technical Specification 26 27 17 Programmable Logic Controller

.22 Technical Specification 26 27 26 Wiring Devices

.23 Technical Specification 26 28 16 02 Molded Case Circuit Breakers

.24 Technical Specification 26 29 01 Contactors

.25 Technical Specification 26 29 03 Control Devices

.26 Technical Specification 26 29 04 Transmitters and Indicators

.27 Technical Specification 26 29 05 Data Communications Infrastructure

.28 Technical Specification 26 29 10 Motor Starters to 600V

.29 Technical Specification 26 29 23 11 Variable Frequency Drive

.30 Technical Specification 26 33 53 Static Uninterruptible Power Supply

.31 Technical Specification 26 50 00 Lighting

.32 Technical Specification 26 52 00 Emergency Lighting

.33 Technical Specification 26 54 00 Heaters and Ventilation

1.2 REGULATORY REQUIREMENTS

.1 Definitions:

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in this Technical Specification, and on Contract Drawings, are those defined by IEEE SP1122.

.2 Reference Standards:

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 CSA C22.2 No. 1-10, General Requirements - Canadian Electrical Code, Part 2, Current Edition.

.3 CAN3-C235-83, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, Current Edition.

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Municipal Construction Documents Association (MMCDA)

.1 Master Municipal Construction Documents, Current Edition (MMCD)

1.3 TECHNICAL SPECIFICATION INCLUDES

.1 This Technical Specification covers items common to the Divisions 26 Technical Specifications. This Technical Specification supplements requirements of Division 1.

.2 This Technical Specification 26 05 00 refers to those portions of the Work that are unique to the supply and installation of all electrical, control, and instrumentation and related appurtenances. This Technical Specification must be referred to and interpreted simultaneously with all other Technical Specifications pertinent to the works described herein.

1.4 SCOPE

.1 This project involves the construction of a booster pump station (P291), as well as the modifications and upgrades of two existing pump stations, W212 and P279. All three pump stations are located in Whistler, BC. W212 is located at 1005 Lynham Road, P279 is located at 1135 Cheakamus Lake Road and the proposed P291 location is next to the existing P279.

.2 The electrical scope of the pump station includes, but is not limited to, the following items of work:

.1 P291:

.1 Supply and installation of Motor Control Centre (MCC) including all VFDs, starters, breakers, controls, distribution equipment, and all other equipment to complete the works.

.2 Supply and installation of Control Panel (CP) including CompactLogix PLC and remote I/O, power supplies, HMI, network switch, fibre patch panel, relays, terminals, and all other equipment to complete the works.

(P291 PLC to provide singular control for remote I/O racks installed in the three stations (P291, P279, and W212))

.3 Supply and installation of RTU Panel and installation of RTU relocated from P279.

.4 Supply and installation of Caustic Soda Fill Panel including terminals, relays, pilot lights, digital panel meters, and all other equipment to complete the works.

.5 Supply and installation of building electrical systems including lighting, receptacles, ventilation controls, fire alarm devices, door contacts, and all other equipment to complete the works.

.6 Supply and installation of instrumentation to support the process equipment, including flow meters, pressure transmitters, temperature transmitters, control valves, position indicators, level sensors, float switches, and all other equipment to complete the works.

.7 Supply and installation of UPS on wall-mounted shelf.

.8 Supply and installation of alarm panel with cellular modem for connection to the Sea to Sky alarm network

.9 Supply and installation of local control panels for ventilation controls, transfer pump, and exterior lighting including pilot devices and relays.

.10 Supply and installation of instrumentation junction boxes.

.11 Supply and installation of heat trace junction box.

.12 Trenching and backfilling to support underground conduit and junction box works.

.13 Supply and installation of fibre optic cabling between P291 and W212, all fibre optic enclosures and connections, and all other equipment to complete the works.

.14 Supply and installation of underground electrical conduits and junction boxes.

.15 Supply and installation of electrical grounding systems.

.16 Supply and installation of raceways including conduits, ducts, cable tray, sleeves, and all other equipment to support the works.

.17 Supply and installation of all wiring and cabling required to support the works.

.2 P279:

.1 Supply and installation of feeder breaker in existing Allen-Bradley 2100 MCC to supply new P291 pump station.

.2 Modifications to existing control panel:

.1 Supply and installation of Allen-Bradley CompactLogix remote I/O rack, network switch, and reconnection of existing I/O to new rack.

.2 Supply and installation of wiring inside the control panel from the existing terminals to the new remote I/O rack.

.3 Supply and installation of pH analyzer and flow meter and all required wiring and cabling.

.3 W212:

.1 Supply and installation of VFD in existing MCC, including new breaker, filters, and cabling.

.2 Supply and installation of level sensor/transmitter.

.3 Modifications to existing control panel:

.1 Supply and installation of Allen-Bradley CompactLogix remote I/O rack and reconnection of existing I/O to new rack.

.2 Supply and installation of HMI.

.3 Supply and installation of wiring inside the control panel from the existing terminals to the new remote I/O rack.

.4 General:

.1 Provide testing and commissioning of the electrical services and systems provided under the Contract Documents.

.2 Provide site commissioning services.

.3 Provide electrical assistance during the commissioning of the Control and SCADA system.

.4 Provide programming and testing services for miscellaneous items including VFDs, electronic breakers, instrumentation, and other configurable components.

.5 Provide all permits, licenses and fees required by applicable Governmental Authorities having jurisdiction.

.6 All work described herein shall be performed by qualified personnel.

.7 Provide seismic engineering and associated materials and equipment as described herein.

.8 Provide vibration isolation equipment and materials including seismic restraints and anchoring.

.9 Preparation of operations and maintenance manuals.

.10 Provision of training for the operation and maintenance teams.

1.5 REMOVAL OF REDUNDANT MATERIAL AND EQUIPMENT

.1 P279:

.1 Remove all RTU I/O cards, battery, and charger.

.2 Relocate RTU CPU, frame, chassis, and power supply from P279 control panel to the control panel in P291 as indicated in the Contract Drawings.

.2 W212:

.1 Remove pump #1 and #2 soft starters, including disconnects, current transformers, cabling, and pump feeders.

.2 Remove pump #2 stand-alone MCC section from the station.

.3 Remove pump #1 and #2 power factor capacitors.

.4 Remove RTU, radio, and antenna.

.5 Remove Well 3-00 level transmitter.

.6 Remove Well 2-99 flow meter, pressure transmitter, level transmitter, and all redundant wiring.

1.6 DEFINITIONS

.1 The word ‘Install’ means the Supply, delivery, and installation of device or equipment referenced to the level required to be complete and operational including unloading, unpacking, assembling, erecting, applying, finishing, protecting, and cleaning.

.2 The word ‘Supply’ means to obtain and deliver to the Site, ready for unpacking, assembly, and installation.

.3 AHJ: Governmental Authority having jurisdiction.

.4 Schematic or Elementary Diagram

.1 A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

.5 Single-Line Diagram

.1 A single-line diagram shows, by means of single lines and graphical symbols, the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.

.6 Block Diagram

.1 A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

.7 Wiring Diagram or Connection System

.1 A wiring or connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly. This diagram may be (a) in a form showing interconnecting wiring only by terminal designation (wireless diagram), or (b) by panel layout diagram showing the physical location of devices plus the elementary diagram.

.8 Interconnection Diagram

.1 An interconnection diagram shows all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams which interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable. Each wire identification as actually installed shall be shown. The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification. All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams. Wires or jumpers shown on the equipment connection diagrams shall not be shown again on the interconnection diagram. Signal and DC circuit polarities and wire pairs shall be shown. Spare wires and cables shall be shown.

.9 Arrangement, Layout, or Outline Drawings

.1 An arrangement, layout, or outline drawing is one which shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

1.7 DRAWINGS, MEASUREMENTS, AND NOTATIONS

.1 Contract Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work.

.2 The Contract Drawings show approximate locations of equipment and apparatus, but the right is reserved to make such changes in location before installation or performance of the work as may be necessary to meet the exigencies of construction in any way. No extra will be allowed and conversely, no credit shall be expected for such changes unless for each item of work the distance moved exceeds 3m prior to final installation of same.

.3 Take field measurements where equipment and material dimensions are dependent upon building dimensions.

.4 The Contractor shall supply and install all electrical equipment. Standard notations are used on the Contract Drawings to assist the Contractor in identifying what work needs to be done. These standard notations are defined as follows:

.1 “All equipment is proposed unless noted otherwise” – This notation is used on Contract Drawings where the majority of the equipment on the drawing is to be supplied and installed by the Contractor. The notation means that the Contractor shall perform all work shown on the Contract Drawing except for equipment shown as existing (i.e. to remain).

.2 “All equipment is existing unless noted otherwise”: - This notation is used on Contract Drawings where the majority of the equipment is existing. The notation means that the Contractor shall perform only the Work identified on the Contract Drawings.

1.8 RESPONSIBILITY AND COORDINATION

.1 Provide all labour, materials, equipment, tools, and incidentals necessary to provide a complete electrical installation as indicated on the Contract Drawings and as set out in these Technical Specifications.

.2 Without relieving the Contractor of his responsibilities, the Technical Specifications have been divided into approximate trade sections for convenience. The use of these sections do not, however, limit the responsibility of the Contractor or any Subcontractor or Supplier. The onus of defining the extent of the Subcontractors' work remains with the Contractor, who, when awarding subcontracts, will ensure that the area of responsibility of any particular Subcontractor is set out in full detail.

.3 The Contractor shall advise the Contract Administrator of any specified material or equipment which is either no longer available from manufacturers or whose delivery is likely to exceed the requirements of the anticipated Work Schedule. Failure of the Contractor to perform the above shall cause the Contractor to supply, at his own expense, alternate material or equipment as selected by the Contract Administrator at a later date. Alternatively, the Contractor shall procure the specified material or equipment at his own additional expense by means of air freight or other special means of transportation.

.4 Advise the Contract Administrator of any specified equipment, material, or installation of same which appears inadequate or unsuitable or which is in violation of Laws, ordinances, rules, or regulations of Governmental Authorities having jurisdiction. Provide all labour and materials which are obviously necessary or reasonably implied to be necessary to complete the work as if the work was shown on the Drawings and/or described in the Specifications.

.5 Check drawings of all trades and coordinate the installation of all material and equipment to ensure adequate space and free access and to maintain headroom limitations for all proposed and indicated future work. Work out jointly, with all Subcontractors on the Site, solutions to interference problems. Coordinate all work before fabricating or installing any material or equipment. It is incumbent on all Subcontractors on the Site to ensure that all materials and equipment fit into the allocated spaces and that all equipment can be properly inspected, serviced, and replaced if and when required. Advise the Contract Administrator of space problems before fabricating or installing any material or equipment. Demonstrate to the Contract Administrator on completion of its work that all equipment and material installed by the Contractor can be properly and safely serviced and replaced. Make no deviations from the intent of the design, or any involving additional cost, without the Contract Administrator's written direction.

.6 Ensure that any building structure loaded during the installation is adequate to carry such load.

.7 A contractor is entitled to engage in the regulated work for which the contractor is licensed.

.1 A licensed contractor must not:

.1 Manage or do regulated work that is:

.1 Outside the scope of the license,

.2 Contrary to any term or condition of the license, or

.3 Contrary to any term or condition imposed by the regulations on the use of the license, or

.2 Permit regulated work to be undertaken by persons under the control of the licensed contractor if they are not authorized.

.2 A licensed contractor must:

.1 Maintain current knowledge of the Applicable Laws, relevant regulations, relevant directives, relevant safety orders and any other relevant material that the minister makes publicly available, and

.2 Ensure that individuals who do regulated work for the licensed contractor maintain similar current knowledge.

1.9 COMMON PRODUCT REQUIREMENTS

.1 All products and warranties shall be registered in the Owner's name.

.2 Products shall be purchased through authorized supply chains to ensure that all warranties and technical support remain valid in British Columbia following installation of the products.

.3 Any products installed that had their warranties or technical support voided for any reason shall be replaced at the Contractor's expense with an identical replacement product that has a valid warranty in British Columbia. Any resulting costs from complications that require remediation from products with voided warranties or technical support shall be borne solely by the Contractor to make the Work good.

.4 Contractor is responsible to ensure that all products are purchased from the OEM or an OEM authorized supply chain/channel such as an authorized distributor or reseller. Any non-OEM products installed shall be replaced at the Contractor's expense, even if non-OEM products are discovered after completion of the project. Any resulting costs from complications that require remediation from the use of non-OEM products shall be borne solely by the Contractor to make the Work good.

.5 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections or field reviews. Inspection does not relieve responsibility but is precaution against oversight or error. Contractor to remove and replace defective products at own expense and is responsible for any delays and expenses caused by rejection.

.6 Contractor shall provide letters of assurance from the OEM manufactures identified throughout the specifications which assure that the products purchased as part of the project were purchased through an OEM authorized channel and that the products are new.

.1 Details on required letters of assurance from OEM manufacturers are provided in Section 1.19 Closeout Submittals.

1.10 TESTING, OPERATION AND SET-UP

.1 Testing in accordance with Technical Specification 26 05 10 Testing and Commissioning.

1.11 PERMITS, FEES, AND INSPECTIONS

.1 Before commencing work obtain and pay for all necessary approvals and permits. The Contract Administrator shall provide any documents required by the Authority Having Jurisdiction to obtain such permits.

.2 Arrange for inspection of the work at rough-in completion, prior to Substantial Completion, and as otherwise required by all applicable Authorities Having Jurisdiction.

.1 Notify Contract Administrator of any changes required by the Authorities Having Jurisdiction prior to proceeding with changes.

.3 Provide Contract Administrator with a certificate of unconditional approval for all electrical work from the appropriate Authorities Having Jurisdiction. Final payment to the Contractor shall not be made prior to submission of the inspection certificate.

1.12 EVALUATION OF CONTRACT CHANGES

.1 In accordance with Division 1 specifications.

1.13 MEASUREMENT AND PAYMENT

.1 In accordance with Division 1 specifications.

1.14 REVIEW OF WORK

.1 In accordance with Division 1 specifications.

1.15 SCHEDULING OF WORK

.1 Work shall be scheduled as required to coordinate with other Divisions and Owner’s work restrictions.

1.16 ACTION AND INFORMATIONAL SUBMITTALS

.1 In accordance with Division 1 specifications.

1.17 SHOP DRAWINGS

.1 Provide digital copies of shop drawings in PDF format. Organize and separate shop drawings per Technical Specification for review.

.2 The Shop Drawing will be retained by the Contract Administrator for their office use and a copy will be marked and returned to the Contractor for correction if necessary, further reproduction, and distribution as required.

.3 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.

.4 Where specifically noted in other Technical Specifications in Division 26, submit drawings stamped and signed by Professional Engineer registered or licensed in British Columbia, Canada.

.5 Contractor shall review all Shop Drawings prior to submittal. All Shop Drawings shall be stamped and signed by the electrical Subcontractor engaged by the Contractor. Unstamped drawings will be marked “re-submit” (R3) without comment.

.6 All Shop Drawings shall use metric dimensions. Scaled drawings shall use metric scale.

.7 Each Shop Drawing shall clearly indicate the equipment ID and equipment type (e.g., Luminaire Type ‘A’, Panelboard SD-A) where applicable.

.8 Where manufactures’ brochures that include multiple equipment or device models are submitted, they shall be clearly labelled with the equipment model and options to be supplied. Submit relevant sections of manufacturer’s catalogues only. Submissions of complete catalogues will be rejected.

.9 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.10 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.11 Indicate on Shop Drawings clearance requirements for: operation, maintenance, and replacement of operating equipment devices.

.12 Submit complete Shop Drawing packages for each system. Partial submissions will be returned without comment.

.13 Review of Shop Drawings by the Contract Administrator is for the sole purpose of ascertaining conformance with the general design intent. The review shall not mean approval of the detail design inherent in the Shop Drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of its responsibility for errors or omissions in the Shop Drawings or of its responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

.14 Shop Drawings stamped as “Revise and Resubmit” to be corrected and resubmitted by the Contractor within 10 days of the Shop Drawing review.

.15 Ensure that copies of all accepted Shop Drawings are available at the job site.

1.18 CLOSEOUT SUBMITTALS

.1 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.2 Operation and Maintenance Manuals:

.1 Provide draft version of Operations and Maintenance Manual to Contract Administrator two weeks prior to Substantial Performance Review.

.3 Upon completion of all electrical, control, and instrumentation work, submit Record Drawings, including all as-built information and changes.

1.19 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain at Site for Contract Administrator 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 in secure location.

.3 Label record documents and file in accordance with section number listings in list of contents of this project manual.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Contract Administrator.

.6 Obtain and pay for three sets of white prints. As the project progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the Site at all times and present for scrutiny at each project meeting.

.7 Show on the Record Drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.

.8 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.

.9 Maintain in the site office in up-to-date condition, one (1) complete set of whiteprints of each of the electrical Contract Drawings and one (1) set of Technical Specifications, including revisions to the Contract Drawings, marked clearly and indelibly in red, indicating as-built conditions where such conditions deviate from the original directions of the Contract Documents, and indicating final installation of feeders and branch circuits.

.10 ”As-Built” markings shall include the following:

.1 All changes in circuiting.

.2 Size and routing of all conduits for branch circuits including power, lighting, and systems. Note that branch circuit wiring is generally not shown on Contract Drawings. Accurately record on "As-Built" drawings the size and routing of all installed raceways and cables.

.3 Number and size of conductors in raceways and cables

.4 Location of all junction and pull boxes

.5 Location of all access panels

.6 Location of all conduit or duct stubs, installed equipment, devices, and fixtures

.7 All changes to electrical installation resulting from Addenda, Change Orders, and Field Instructions (Architectural / Engineering Instructions)

.8 Exact location of all services left for future work

.9 Location by accurate horizontal and vertical dimensions of the routes and terminations of all raceways and cables installed underground beyond the building.

.10 Exact labeling of each communication system cable at each data outlet location. Locate label numbers adjacent each communication outlet indicated on Contract Drawings. Label numbers to match those at the communication room cable end.

.11 Where extensive changes have been made to an area to the point where it is not practical to update the original Contract Drawing, the area in question shall be enclosed with a heavy dotted line and reference made to the applicable Change Order, Instruction, and/or associated Revision Drawing.

.12 For each and every "As-Built" drawing, reference shall be neatly drawn inside the framed space above the title block, listing all Contemplated Change Orders, Instructions, and Revision Drawing Numbers applicable to the particular "As-Built" drawing in question.

.13 Each "As-Built" drawing as defined above shall bear the Contractor's identification and signature, the date of record, and the notation: "We hereby certify that these drawings represent the work as built."

.14 All Addenda and Revision Drawings not having their details transferred onto the submitted "As-Built" drawings shall be included in the submission using the same drawing format as previously described.

.11 Recording Information on Project Record Documents.

.1 Record information on set of Contract Drawings.

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

.3 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and Shop Drawings: mark each item to record actual construction, including:

.1 Changes made by Change Orders.

.2 Details not on original Contract Drawings.

.3 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, as required by Technical Specifications.

.7 Provide digital photos, if requested, for site records.

1.20 OPERATION AND MAINTENANCE MANUAL

.1 Submission:

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

.2 Copy will be returned after final inspection, with Contract Administrator's comments.

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

.4 As a condition of Substantial Completion submit to the Contract Administrator, four final copies of operating and maintenance manuals in English.

.5 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.

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. The Contractor shall replace products at their own expense, with no increase to the Contract Price.

.8 Pay costs of transportation.

.2 Format

.1 Organize data in the form of an instructional manual.

.2 Provide a digital copy of the O&M manual in PDF format.

.3 Arrange content by systems under Technical Specification numbers and sequence of Table of Contents.

.4 Provide organized digital bookmarks for content by systems under Technical Specification Numbers and sequence of Table of Contents.

.3 Contents – Each Volume:

.1 Table of Contents: provide title of Project;

.1 Date of submission; names,

.2 Addresses, and telephone numbers of Engineer 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

.1 Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings

.1 Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text

.1 As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

.6 Guarantees, Warrantees and Bonds

.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 the applicable item of work.

.4 Except for items put into use with Owner's permission, leave the date of when the warranty begins blank until the Substantial Completion Date is determined. The beginning date of the warranty will then be updated to state the Substantial Completion Date.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.7 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 list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.12 Additional requirements: As specified in the Contract Documents.

1.21 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to Site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.1 Except for equipment intended for installation outdoors, store equipment indoors in dry location.

.2 Store and protect equipment and materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.3 Packaging Waste Management: remove and dispose of all packaging waste materials.

.1 Where possible, return packaging materials to supplier for re-use.

.2 Divert all recyclable materials from landfill.

1.22 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with the Contract and the Division 1 Technical Specifications.

.2 Qualifications: electrical work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Electrical Safety Regulation within the Electrical Safety Act and the Building Code and By-Laws.

.1 Employees registered in provincial apprentices' program: permitted, under direct supervision of qualified licensed electrician, to perform installation tasks.

.2 Submit list showing names and qualifications of key supervisory personnel.

1.23 SAFETY AND PRECAUTION

.1 Safety practices shall include the following requirements:

.1 Compliance with safety requirements provided in the Contract Documents

.2 Workers' Compensation Board Regulations

.3 Municipal By-Laws

.4 Canadian Electrical Code

.5 Electrical Safety Act of BC

.6 Municipal, Provincial and Canadian Building Code

.2 Tests shall be performed with apparatus de-energized unless otherwise specified (e.g., rotation, phasing).

.3 Power circuits shall have conductors shorted to ground by an approved hotline grounded device.

.4 In all cases, work shall not proceed until the Contractor's safety representative has determined that it is safe to do so.

.5 The Contractor shall have sufficient protective barriers and warning signs available, where necessary, to conduct specified tests safely.

.6 The Project safety procedures shall be reviewed and accepted by the Contractor and all sub-trades.

1.24 CARE, OPERATION, AND START-UP

.1 Instruct Contract Administrator and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.25 APPROVALS

.1 Without limiting or restricting the contents of the Contract Documents, requests for approval of the substitution of materials pertaining to electrical work must be submitted to the Contract Administrator and the Owner in accordance with the Review Procedure.

.2 All submissions shall include the following information:

.1 Name and identification of specified item.

.2 Manufacturer, brand name, and catalogue number of the alternative item proposed.

.3 Detailed technical data and characteristics of alternative item such as dimensions, voltage, power requirements, performance characteristics, etc.

.4 Request for lighting fixture substitutions must be followed by photometric data and Shop Drawings.

.5 A list of any and all changes to the installation which may be required as a result of the substitution.

.3 Materials, equipment, apparatus, light fixtures, or other products specified by manufacturers' brand name, type, or catalogue number are so specified in one of two ways:

.1 Specified item followed by the words “or equal” or “approved equal” or preceded by the words “equivalent to” or “equal to”; when the Technical Specification is so worded, it is intended to establish a specific standard of quality and style but the item may be substituted for, provided the Contract Administrator provides its written approval. It is the responsibility of the Contractor to assure the Contract Administrator that all features of the specified items are supplied as part of the substitute item. If the Contract Administrator does not provide its written approval for a substitute item, the item shall be supplied precisely as specified in the Contract Documents.

.2 Specified items not followed or preceded by any such qualifying phrases: When the Technical Specification is so worded, the item shall be supplied as specified and no approved equals or equivalents will be allowed.

.4 Review by the Contract Administrator of alternate materials as permitted above is only a general approval in principal and shall not relieve the Contractor of its responsibility to ensure that any approved alternate materials perform in the same manner and with the same intent as the originally specified material would have otherwise performed.

.5 Where such substitutions alter the design or space requirements indicated on the Contract Drawings, include all material, labour, design, and engineering costs for the revised design and construction including costs of all other trades affected and those incurred by the Owner and Contract Administrator.

.6 It is the Contractor's responsibility to ensure substituted products are approved and that Suppliers have written approval indicating conditions of any such approval. Alternate manufacturers who do not have such approval shall not be used in the work. If requested by the Contract Administrator, the Contractor for Division 26 shall submit for inspection, samples of both the specified and the proposed substitute items on short notice.

Part 2 Products

2.0 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

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

.3 Language operating requirements: provide identification nameplates for control items in English.

2.1 MATERIALS AND EQUIPMENT

.1 Equipment and material shall be new and certified by a certification body accredited by the Standards Council of Canada (SCC). Where there is no alternative to supplying equipment which is not certified, obtain special approval and pay all associated fees. Notify Contract Administrator prior to supplying material that is not SCC approved.

.2 Factory assemble control panels and component assemblies.

.3 Substitution of Products

.1 After acceptance of the list of products, no substitution of any item will be permitted unless the approved item cannot be delivered in time to comply with the work schedule and the Contract Administrator accepts the change in items.

.2 To receive acceptance, proposed substitutes must equal or exceed the quality, finish and performance of those specified in the Contract Documents and/or shown in the Contract Drawings and must not exceed the space requirements allotted on the Contract Drawings.

.3 Provide to the Contract Administrator documentary proof of equality, difference in price (if any) and delivery dates, in the form of certified quotations from suppliers of both specified items and proposed substitutions.

.4 Include costs for any required revisions to other structures and products to accommodate such substitutions.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated in the Technical Specifications and Contract Drawings.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

.1 Identify equipment cabinets with nameplates as follows:

.1 Nameplates:

.1 Lamacoid 3 mm thick plastic engraving sheet, lettering accurately aligned and engraved into core, mechanically attached with self-tapping screws or permanent self-adhesive.

.2 Nameplate colours as follows:

.1 Normal Power Systems: black face, white core

.2 Emergency/Standby Power Systems: red face, white core

.3 Life Safety Systems: red face, white core

.4 Colours for other equipment as specified by the Contract Administrator.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise in the Contract Drawings.

.3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Refer to Technical Specification 26 05 21 – Wires and Cables (0-1000V).

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Refer to Technical Specification 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

2.8 FINISHES

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

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

.4 Repair or replace any equipment or structures damaged by the Work, to its original condition at no cost to the Owner.

Part 3 Execution

3.0 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Technical Specifications are acceptable for installation in accordance with manufacturer's written instructions.

.2 Visually inspect substrate in presence of Contract Administrator.

.3 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.1 INSTALLATION

.1 Complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise in the Contract Drawings.

3.2 NAMPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

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

.1 Sleeves through concrete: schedule 40 plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise in the Contract Drawings.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.6 FIELD QUALITY CONTROL

.1 Refer to Technical Specification 26 05 10 Testing & Commissioning.

3.7 SUBSTANTIAL PERFORMANCE REVIEW

.1 Prior to the Contractor submitting an Application for Substantial Completion, the Contractor will submit written confirmation that:

.1 All wiring devices, cover plates, motor controls, lighting fixtures, and other equipment are operational, plumb, clean, and correctly labelled.

.2 All distribution equipment (cabinets, panels, distribution transformers, etc.) has been cleaned and vacuumed.

.3 All test reports have been submitted.

.4 All auxiliary systems have been tested as required and are in good and proper working order.

.5 All certificates of final acceptance from the authorities having jurisdiction have been received and submitted to the Contract Administrator.

.6 Factory finished equipment has been cleaned, touched up, or refinished as necessary to present a new appearance.

.7 All sealing of conduits, cables, cable trays, wireways, etc. at wall, ceiling, and floor penetrations have been completed.

.8 All lighting fixtures including lenses and reflectors have been properly cleaned as specified in the Contract Drawings.

.9 All loose equipment including spare parts and replacement parts have been turned over to the Owner and receipts obtained for same.

.10 The operations and maintenance manuals have been submitted.

.11 All demonstrations and instructions to the Owner have been completed.

.12 Verification letter from Seismic Engineer has been submitted.

.2 Provision of the above shall not be construed as compliance with all administrative documentation required.

.3 Notwithstanding any other provisions of the Contract, failure if the Contractor fails to complete all of the requirements in this section 3.7 the Contract Administrator may refuse to issue a Certificate of Substantial Completion.

3.8 SYSTEM START-UP

.1 Arrange and pay for services of manufacturer's factory service representative to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with aspects of its care and operation.

3.9 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment.

.3 Where work is performed in a phased manner, or Owner will take partial occupancy of the area of Work, perform final cleaning at the end of each Phase or prior to Owner taking occupancy of each area.

.4 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END SECTION

TABLE OF CONTENTS

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
P2	September 22, 2023	Issued for Tender	WW	BW
P1	August 30, 2023	Issued for Final Review	WW	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

.2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by the Specifications.

.3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.

.4 The Contractor will ensure that the total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements (the “Seismic Consultant”). Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Consultant. The Seismic Consultant will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

.5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the Project. Any changes in conditions will not result in an increase to the Contract Price unless otherwise stated in the Contract Documents

.6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the Project Binder.

.7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

.8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies in accordance with Section 21.1 of the Contract

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 29 Hangers and Supports for Electrical Systems

1.3 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.

.2 The Contractor's seismic consultant shall submit original signed BC Building Code Letters of Assurance Schedules S-B and S-C to the Contract Administrator together with Shop Drawings submission.

.3 Importance Factor: 1.5.

.4 Use the Electrical Contractors Association of BC details in the absence of any local requirements.

.5 The above requirements shall not restrict or supplant the requirements of any Applicable Laws, including local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the Seismic Consultant.

.3 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 GENERAL

.1 Seismic Restraint Systems (SRS) shall be designed to avoid high impact loads.

.2 SRS shall restrain seismic forces in all directions.

.3 Fasteners and attachment points shall resist same load as seismic restraints.

.4 SRS utilizing cast iron and other brittle materials is not acceptable.

.5 Equipment assemblies required to be vibration/noise isolated shall be provided with seismic rated isolators and restraints which are certified as being rated for the specification application requirements.

.6 Seismic control measures shall not interfere with integrity of fire stopping.

2.1 SLACK CABLE SYSTEMS

.1 Slack shall prevent sway in a horizontal plane, rocking in a vertical plane, sliding and buckling in axial direction.

.2 Hanger rods shall withstand compressive loading and buckling forces.

.3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.

.4 Coordinate requirements of slack cables with suppliers prior to installation.

Part 3 Execution

3.1 GENERAL

.1 All seismic restraints systems shall conform to Governmental Authorities, including local authority having jurisdiction, applicable laws, and code requirements.

3.2 CONDUITS

.1 Provide restraint installation information and details on conduit and equipment as indicated in Section 3.2 of this Technical Specification:

.2 Vertical Conduit

.1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.

.2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m o.c.

.3 Riser joints shall be braced or stabilized between floors.

.3 Horizontal Conduits

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

.4 Do not brace conduit runs against each other. Use separate support and restraint system.

.5 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

.6 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.

.7 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

.8 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.

.9 The Contractor will ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on Shop Drawings. The Contractor will review the Shop Drawings with Seismic Consultant and submit Shop Drawings to the Contract Administrator for their reference.

3.3 FLOOR MOUNTED EQUIPMENT

.1 Bolt all equipment, (including transformers, kiosks, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks) to the structure. Seismic Consultant shall design anchors and bolts.

END SECTION

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Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
P2	September 22, 2023	Issued for Tender	WW	BW
P1	August 30, 2023	Issued for Final Review	WW	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 The Contractor to take note that the demolition and renovation will be done in an occupied building that is normally occupied during the day and during the evenings, seven days a week, year-round. Maintain electrical and communication systems as required to minimize services disruption.

.2 The work of this contract shall be done in a phased manner to allow operations in the renovated area to continue. Refer to the Construction Manager's phasing plan and schedule. To be confirmed prior to the work commencing.

.3 The Electrical Division to also take note of the dust containment requirements as outlined in the architectural and front-end specification.

.4 Electrical tender documents do not show all existing luminaires, wiring devices, conduit, boxes or wire. Conduit routing and wire grouping is not known. During demolition, the Electrical trade(s) are to deactivate all existing electrical and communication systems affected in such a manner that complete systems are not deactivated and system circuits affected in party wall partitions to be reactivated immediately on a temporary or permanent basis as site conditions dictate.

.5 Any discrepancies appearing on the Contract Drawings or in this specification are to be brought to the attention of the Contract Administrator who will provide instruction.

.6 Where devices are not shown on the new plans in walls that are not being removed, such devices are to be reinstated and remain.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 BCBC – British Columbia Building Code, Current Edition.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Section 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 STANDARDS

.1 Refer to applicable material standards in other Technical Specification sections and/or as detailed on Contract Drawings.

Part 3 Execution

3.0 DEMOLITION

.1 Demolition to be carried out in strict conformance to provincial, local and municipal authorities and Part 8 of the B.C. Building Code current edition.

.2 All redundant electrical components in the areas of demolition excluding those specifically identified, shall become the property of the Electrical Division and shall be removed from site.

3.1 DISRUPTION TO OPERATIONS

.1 Contractor to issue a scheduled shutdown time and coordinate installation of the new equipment as appropriate. All equipment installed and modified requires testing before start-up.

.2 Contractor to provide temporary connections to all required equipment for temporary power during the installation of any new equipment.

3.2 REUSE OF EXISTING COMPONENTS

.1 Existing components may be reused only where so specifically indicated on the Contract Drawings or in the Technical Specifications. In all cases wiring shall be new and no splicing shall be permitted at any location. All lighting switches and all receptacles shall be new.

3.3 DISRUPTION OF CIRCUITS

.1 Circuit: power, voice/data, fire alarm, control etc. which are disrupted during demolition and are essential, to be made good immediately. The Electrical Trade(s) to identify these circuits to the Contract Administrator. Specific tasks involving the demolition of essential circuits will require that the contractor obtain permission from the Owner before proceeding.

3.4 ABANDONED CONDUIT, WIRE AND EXISTING CIRCUITS

.1 Except as specifically noted, all abandoned conduit and wire to be removed and disposed of by the Electrical Divisions.

.2 Remove all accessible (e.g., surface) wiring and cables back to source.

.3 Remove abandoned outlets and raceway, even if in or behind drywall, where they are located behind millwork or in locations unsuitable for reuse (i.e., not at standard heights for switches or outlets).

.4 All remaining circuits to be rerouted as required and suitably secured to the building structure to CEC Standards.

.5 Any cabling, including voice/data wiring, presently resting on any suspended ceiling system to be removed as part of the renovation process and shall be neatly bundled, protected, and permanently secured to building structure. No cabling is permitted to rest on the ceiling system.

END SECTION

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P2	September 22, 2023	Issued for Tender	WW	BW
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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Provide testing and commissioning services and equipment to assure that all electrical equipment is operational within industry manufacturers' tolerances, calibrated per the power system studies, complies with all applicable codes, is installed in accordance with design specifications, and functions in the system in the manner designed by the Consultant.

.2 Inspections, calibrations, and acceptance tests for all equipment systems shall be performed. The inspections and testing activities shall be divided among the following groups, as specified in this Section:

.3 The original equipment manufacturer's authorized service representative shall provide special equipment, labour, and technical supervision, when required, in addition to what is supplied by the Contractor.

.4 Inspections, calibrations, and acceptance tests for equipment and systems not requiring the services of the manufacturer's representative shall be performed by the Contractor.

.5 In cases where equipment and systems require the involvement of two or all of the parties, the parties mentioned above shall coordinate and perform all inspection and testing requirements. The Contractor shall be responsible for coordination of the work and ensuring that the requirements of this Section are met.

.6 All testing and commissioning to be carried out in accordance with the terms of this Contract.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

1.3 REFERENCES

.1 Definitions:

.1 Stage 1 – Functional Testing (By the Contractor)

.1 **"Functional Testing"** refers to the stage of testing where the Contractor and sub-contractors provide end to end testing and documentation of all pump station elements to ensure correct operation and consistency with the design (labels, lamacoids, settings, etc.).

.2 Stage 2 – PLC/HMI/RTU Configuration and Programming (By the Consultant)

.1 **"PLC/HMI/RTU Configuration and Programming"** refers to the stage of testing where the Consultant provides PLC, HMI, and RTU configuration and programming.

.3 Stage 3 – Commissioning (By the Consultant)

.1 **"Commissioning"** refers to the stage of testing where the Consultant demonstrates complete system functionality.

.4 Stage 4 – Performance Testing (By the Contractor)

.1 **"Performance Testing"** refers to the stage of testing post Commissioning, where the Contractor will remain on-site and demonstrate complete trouble-free system functionality for a period of two (2) weeks.

.5 Stage 5 – Verification (By the Owner)

.1 **"Verification"** refers to the stage of testing where the Owner will perform Quality Control verifications.

.2 Reference Standards:

.1 All inspections and tests shall be in accordance with, but not limited to, the following applicable codes and standards except as provided otherwise in this Section.

.1 International Electrical Testing Association - NETA

.2 National Electrical Manufacturer's Association – NEMA

.3 Canadian Electrical Manufacturers Association - CEMA

.4 American Society for Testing and Materials - ASTM

.5 Institute of Electrical and Electronic Engineers – IEEE

.1 1584-2018, Guide for Performing Arc-Flash Hazard Calculations

.6 American National Standards Institute – ANSI

.1 ANSI Z535.4-2011 (R2017), Product Safety Signs and Labels

.7 Canadian Electrical Code - Parts 1 and 2

.8 Canadian Standards Association – CSA

.1 CSA Z462-21, Workplace electrical safety, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment to protect against shock and arc flash hazards.

.9 Insulated Power Cable Engineers Association - IPCEA

.10 National Fire Protection Association - NFPA

.11 ANSI/NFPA 70B: Electrical Equipment Maintenance

.12 WCB Regulations

.13 CANICSA-B72-M87: Lightning Protection Code

.14 Municipal By-Laws

.2 All inspections and tests shall utilize the following references:

.1 Project design drawings and specifications

.2 Shop drawings and submittals

.3 Manufacturer's instruction manuals applicable to each particular apparatus

.4 Applicable NETA acceptance testing work scope sections per NETA ATS (Latest Edition)

1.4 QUALIFICATIONS

.1 The Contractor shall retain the services of an individual that is qualified to test electrical equipment and is approved by the Consultant.

1.5 COORDINATION

.1 The Contractor shall contract the associated sub-contractors and suppliers to provide on-site testing and commissioning support services for the different components of the pump station including, but not limited to, the following:

.1 Pump Supplier

.2 Control Panel Supplier

.3 MCC Supplier

.4 VFD Supplier

.5 Instrumentation Supplier

.2 The Contractor, their associated sub-contractors, and suppliers shall be available during the Commissioning activities. This includes, but is not limited to:

.1 Entire Duration:

.1 Instrumentation Technician

.2 Electrician/Wireman

.2 As Required:

.1 VFD Specialist

.2 Other Device Specialists

.3 The Contractor shall provide configuration, functional testing, and system operation testing and verification of all individual components.

.4 Coordinate the factory field-testing and assistance per the requirements of this Section.

1.6 SUBMITTALS

.1 Submit the qualifications of the individual(s) doing testing and commissioning according to this Section for approval.

.2 Submit the coordinated test schedule for approval.

.3 Submit detailed test procedures corresponding to the requirements in this Section for approval. The test procedures shall be detailed test instructions, written with sufficient step-by-step information to allow a test to be repeated under identical conditions. List all setpoint values and acceptable results for each condition tested.

.4 Submit a preliminary copy of the hand-written field test results to the Consultant and the Owner within one (1) week after the test is completed.

.5 Prior to energization of equipment, submit a letter certifying that the electrical installation being energized complies with contract documents, applicable codes, and proper system operation.

.6 The test reports shall be compiled and submitted in formal form with a summary.

1.7 OPERATIONS AND MAINTENANCE (O&M) MANUALS

.1 Operations and Maintenance Manuals shall be in accordance with 26 05 00 Common Work Results – Electrical.

1.8 SCHEDULING

.1 Perform all testing after installation and before energizing. All systems shall pass tests prior to being put into service.

.2 The Contractor, in coordination with the equipment manufacturer's representatives, shall confirm the test schedule with the Consultant prior to the test. The Contractor shall coordinate the test schedule so that the Consultant can witness the testing, if required.

.3 Testing and calibration of electrical equipment shall be completed prior to the start of commissioning activities. When required during commissioning, the Contractor shall retest and re-calibrate equipment to support the commissioning activities.

1.9 MEETINGS

.1 Pre-Commissioning conference: The *Contractor* shall request a pre-commissioning conference with the Consultant (conference calls accepted).

1.10 SAFETY AND PRECAUTIONS

.1 Safety practices shall include, but are not limited to, the following requirements:

.1 Workers' Compensation Board Regulations

.2 Municipal By-Laws

.3 Canadian Electrical Code

.4 Electrical Safety Act of BC

.5 Municipal, Provincial and Canadian Building Code

.2 Tests shall be performed with apparatus de-energized unless otherwise specified (e.g., rotation, phasing).

.3 Power circuits shall have conductors shorted to ground by an approved hotline grounded device.

.4 In all cases, work shall not proceed until the Contractor's safety representative has determined that it is safe to do so.

.5 The Contractor shall have sufficient protective barriers and warning signs available, where necessary, to conduct specified tests safely.

.6 The Project safety procedures shall be reviewed and accepted by the Contractor and all sub-trades.

1.11 TEST EQUIPMENT

.1 All test equipment shall be furnished by the Contractor.

.2 Test instrument calibration

.1 The Contractor shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.

.2 The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain.

.3 Up-to-date calibration labels shall be visible on all test equipment.

.3 Use of torque wrenches

.1 Use calibrated torque wrenches for all bolted connections on buses and power cable terminations. Mark the head of the bolt with a coloured marking pen after its being torqued to manufacturer's recommended value.

Part 2 Products

2.0 NOT USED

Part 3 Execution

3.0 REQUIREMENTS

.1 Perform acceptance tests in accordance with manufacturer's recommendations, WCB regulations, and testing specifications NETA ATS (Latest Edition).

.2 Voltage adjustments shall be in accordance with CSA CAN3-C235.83, Preferred Voltage Levels for AC Systems, to 50,000 V.

.3 The test plan, procedures, test results, and reports shall be reviewed, under the supervision of and approved by the Consultant.

.4 Division of responsibility

.1 During Functional Testing the Contractor shall be responsible for the following elements of testing.

.1 End to end testing for all communications and power cabling installed as part of the contract between end devices, any intermediate splice/ terminal junction boxes, and the distributions panels, control panels, and RTU panels.

.2 Individual distribution component testing including the following:

.1 Transformers,

.2 Electrical panels,

.3 Motor circuit breakers,

.4 Ventilation control panels

.5 MCC electrical components; and,

.6 All other electrical components as indicated on the Contract Drawings.

.3 Individual control panel component testing within the factory and in the field following installation including the following:

.1 Push buttons,

.2 Pilot lights,

.3 Control relays,

.4 Control timers,

.5 Control circuit breakers and fuses,

.6 HMI screens,

.7 Hour meters,

.8 E-stop buttons,

.9 PLC controller (test power up),

.10 Radar level transmitters,

.11 Flow meter transmitters; and,

.12 All other components contained within the control panel.

.4 Individual field component testing once installed and powered including the following:

.1 Verification of labelling and identification of field components,

.2 Flow meters,

.3 Pressure transmitters,

.4 Radar level sensors,

.5 Float switches,

.6 Smoke detectors,

.7 Door contacts,

.8 Temperature sensors,

.9 Variable frequency drives,

.10 Motor starters,

.11 Security panel,

.12 and all other instrumentation and control components shown on the Contract Drawings.

.5 The Contractor shall confirm that all devices are powered, and signals are being transmitted between the field devices and the control panel prior to control system integration and testing.

.6 Contractor to configure and setup all Instrumentation.

.7 The Contractor shall coordinate tests to ensure proper functionality of the system.

.2 The PLC/HMI/RTU Configuration and Programming stage(s) shall take place both before and concurrently with Functional Testing. The Contractor shall coordinate with the Consultant's programmer to allow adequate access to the site. During this stage, the Consultant's Programmer will be available to assist with the Contractor's Functional Tests.

.3 After the Functional Testing and Programming stages are complete, the Consultant shall perform Commissioning activities. This includes the following elements of testing.

.1 Demonstrating complete system functionality by running the system through the Process Narrative.

.2 Confirming system functionality through all programming and instrumentation setpoints with the assistance of the Consultant's Programmer.

.4 Once the Contractor has sufficiently demonstrated system functionality to the Consultant's Programmer, Performance Testing shall commence. This includes the following elements of testing.

.1 The Contractor shall remain on site to monitor the system for a period of two (2) weeks.

.2 The system must perform trouble-free from the entire two-week period to meet the performance goal and be considered substantially complete.

.3 If there are any deficiencies, operational issues, or system failures during the two (2) week period, at the Owner's discretion the Performance Test period may be restarted after the issue/deficiency has been addressed.

.5 Verification is the stage of testing where the Owner completes their Quality Control processes to ensure the station has been designed and operates as intended.

.1 The Contractor shall assist the Owner with all related verification tasks and provide an instrumentation technician and electrician for the entire verification process. The Contractor shall also make available the VFD specialist on an as required basis.

3.1 GENERAL TESTING REQUIREMENTS

.1 Contractor shall coordinate and pay for all testing required by the Contract Documents including any additional testing required by authorities having jurisdiction.

.2 All deficient equipment/devices shall be replaced and retested.

.3 Testing for each system shall be performed after the system installation is complete and prior to the system being put into continuous operation.

.4 Advise the Contract Administrator a minimum of five (5) Business Days in advance of each test and carry out tests in the presence of the Contract Administrator.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of Work.

.6 Submit detailed typewritten test reports to the Contract Administrator within five (5) Business Days after the completion of each test. Include all test reports in the Project Binder.

.1 Test reports shall clearly indicate each component that has been individually tested, test results, and whether the results are within acceptable limits.

.2 Each test report shall be accompanied by a cover sheet outlining the test and summarizing any items that have failed the tests.

.3 Cover sheet shall include names, signatures, and contact information of the individuals who conducted the tests.

.7 Protective Device Setting and Testing

.1 All work shall conform to NETA standards.

.2 Ensure circuit protective devices including overcurrent trips, relays, and fuses are installed to required values per protection and coordination study.

.8 The following is a list of general requirements for testing of equipment and cabling to be completed by the Contractor prior to detailed system testing:

.1 The Contractor shall torque down all accessible bolts, perform routine insulation resistance and continuity tests on branch and feeder circuits, and perform rotational tests for all distribution and utilization equipment, prior to, and in addition to tests performed by the Contractor specified in this Section.

.2 The Contractor shall supply a suitable and stable source of test power at each test site.

.3 The Contractor shall clean all the electrical equipment prior to testing.

.4 The Contractor shall be responsible for implementing all final settings and adjustments on protective devices and electrical equipment in accordance with the equipment calibration requirements or Power System Protective Device Studies.

.9 Any questions or concerns identified shall be promptly addressed to the Consultant.

.10 Any system, material, or workmanship which is found defective on the basis of electrical inspections and tests shall be reported directly to the Consultant.

.11 If a test reveals a fault or problem, the materials of equipment under test will be repaired or replaced and the entire test will be repeated. Tests will not be accepted until the problem is corrected. Submit additional written test reports.

.12 Maintain a written record of all tests and, upon completion of the project, assemble and certify a final test report. The field test reports shall be compiled and signed by the individual performing the testing.

.13 Power systems protective device calibration

.1 Adjustments, settings, and modifications

.1 The Contractor shall calibrate necessary field settings, adjustments, and minor modifications to conform to the coordination study without additional cost (examples of minor modifications are trip sizes within the same frame, the time curve characteristics of induction relays, ranges, etc.).

.2 Adjust or replace protective devices to the values provided in the coordination study.

.3 The trip characteristics, when adjusted to setting parameters, shall fall within the manufacturer's published time-current characteristic tolerance.

.2 The Contractor shall verify that the protective devices have been adjusted and set in accordance with the approved Power System Study.

.14 Acceptance criteria

.1 Each function and test shall be performed under conditions which simulate actual operating conditions as closely as possible.

.1 To that end, the Contractor shall provide all necessary materials, equipment, and temporary system voltages and currents to simulate fault conditions on the system being tested in order to prove and verify proper operation (fuses excepted).

.2 At satisfactory completion of all verified tests, the building electrical system being tested shall be returned to the condition required by the contract documents as a complete and operational system.

.2 The Contractor shall perform general inspections at the job site and shall also review the following:

.1 Assembly of the accessory equipment, and the interconnecting wiring for control circuits.

.2 General inspection of the following: appearance, finish, alignment of doors, covers, and similar parts; quality of workmanship; possible shipping and other damage; missing, broken or incorrectly applied devices; loose or missing accessories, bushings, or hardware; loose or broken wires; proper installation of all equipment; verification that shop drawings and instructions have been shipped with all equipment and are available.

.3 Support of electrical equipment: inspect and check all electrical equipment for support and seismic bracing.

.4 Spare equipment: The Contractor shall inspect and verify spare equipment inventory as specified by Division 26.

.3 The Contractor shall provide technical verification of systems installed including the following:

.1 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of tension and power.

.2 Connecting joints and equipment fastening.

.3 Measurements of signals (dB, lux, baud rate, etc).

.4 Compliance with manufacturer's specification, product literature and installation instructions.

3.2 SYSTEM OPERATIONAL TESTING REQUIREMENTS AND PROCEDURES

.1 Infra-Red Scanning

.2 Perform infrared scan of all distribution equipment under loaded conditions (new and existing). Distribution System Testing:

.1 The following equipment and systems shall be inspected and tested by the Contractor per manufacturer's instructions and additional requirements noted.

.2 The following tests require that the Contractor provide materials, tools, and labour (qualified personnel) to prepare equipment and devices for testing and to perform tests and to make adjustments and recalibrations for re-testing as necessary and to reconnect systems after the testing is completed. Include in the Tender, all costs associated with the provision of labour to remove and re-install panel plates, to disconnect/reconnect cables, and perform any labour other than testing, and to provide any materials and tools.

.1 Transformers

.1 Oil and Dry type rated equal to and greater than 600 V.

.2 Tests

.3 Inspect for physical damage, proper installation, anchorage, and grounding.

.4 Verify transformer is supplied and connected in accordance with the Contract documents.

.5 Insulation-resistance (Megger test) test all windings, high to low and ground, low to high and ground.

.6 Verify phase rotation sequence of transformer secondary windings.

.7 Adjust the transformer taps to the nominal system voltages per CSA CAN3-C235.83.

.8 Inspect and check for operation of all other overcurrent protection devices (switch/fuses, circuit breakers). Verify fuse/circuit breaker sizes in accordance with the Drawings.

.9 Insulation resistance (Megger) test of all incoming bus ducts and feeders and extensions to all relocated outgoing feeders and all new outgoing feeders. Ensure that all electronic and other voltage sensitive equipment is disconnected before the tests are applied and reconnect same at completion of test.

.10 After each switchboard has been energized, manually operate each and every circuit breaker or switch and prove that when operated, the device in fact opens all underground conductors at the load end of the feeder and that the device and load have been labeled correctly.

.2 Cables

.1 Apply grounds for a time period adequate to drain all insulation-stored charge.

.2 Insulation Resistance test per NETA ATS 2017 standards.

.3 Other utilization equipment

.4 Switches

.1 Verify correct wire bending radii at terminations per wire manufacturer's recommendations and CEC.

.5 Protective relays and devices

.1 Conduct tests according to the manufacturer's recommended testing procedures.

.2 Calibrate and set all settings according to the Protective Device Coordination Study.

.3 The following equipment shall be inspected and tested by the Contractor. Coordinate activities with the manufacturer's authorized service representatives.

.1 The Contractor shall coordinate with the suppliers and Subcontractors to perform the following tests:

.1 Test secondary voltage levels of all transformers and adjust taps to within 2% of the rated operating voltage of the connected equipment unless directed otherwise by the Consultant. Test reports shall include phase and neutral currents.

.2 Control and switching - all circuits shall be tested for the correct operation of devices, switches, and controls, including sequenced operation of systems where applicable.

.3 Include in the written reports to the Consultant, the time and date on which each load was measured and the voltage at time of test.

.2 General power system tests

.1 Insulation Resistance test all 120 V and higher circuits, feeders, and equipment.

.2 Check resistance to ground before energizing any equipment.

.3 Phase balance - when load conditions are commensurate with actual operating conditions, measure the load and the voltage on each phase at each switchboard, splitter, motor control centre, motor distribution centre, distribution panelboard, and lighting and power panelboard and report the results, including neutral currents, in writing to the Consultant. Rearrange circuit connections as necessary to balance the load on each phase to within 15% of average load. Measure phase voltages at connected loads under fully load conditions and adjust transformer taps to within 2% of rated voltage of equipment. Provide upon completion of the work specified herein, load balance report, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.4 Motor loading - measure the line current of each phase of each motor with the motor operating under load and report the results along with the motor nameplate current in writing to the Consultant. Upon indication of any unbalance or overload, thoroughly examine the electrical connections and rectify any defective parts or wiring. If electrical connections are correct, overloads due to defects in the driven machines shall be reported in writing to the Consultant.

.5 Phase relationship tests: Check connections to all new and existing equipment, outlets and devices for proper phase relationship. During such check, disconnect all devices which could be damaged by the application of voltage or reversed phase sequence.

.3 Low voltage feeder and branch circuit conductors (600 V and below)

.1 Test for continuity of each lighting and heating circuit originating from branch distribution panels.

.2 Test for grounds in each circuit; test shall consist of the physical examination of the installation to ensure that all required ground jumpers, devices, and appurtenances do exist and are mechanically firm.

.3 Perform a 500V M-Ohm meter test on each circuit between the conductor and ground. The insulation resistance shall not be less than 2 megohms for circuits under 120V, 6 M-Ohms between conductor and ground on those circuits (120 - 600 V) with total single conductor length of 2,500 feet and over, nor less than 8 M-Ohms for those circuits (120 - 600 V) with single conductor length of less than 2500 feet. If conductor fails test, replace wiring or correct defect and retest.

.4 Perform torque test for every conductor tested and terminated in an overcurrent device or bolted type connection; torque all connections per manufacturer's recommendations.

.5 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.6 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.7 Check resistance to ground before energizing.

.4 Switchgear and Switchboard Enclosures

.1 Carry out visual inspection of enclosure and verify nameplate data against Supplier’s as-built drawings and specifications.

.2 Torque and ductor test all bus connections and torque test all wire terminations to recommend manufacturer's data. All torqued connections to be sealed with red lacquer.

.3 Carry out electrical continuity phasing check of all bus work per three-line diagram from incoming end to each termination or take-off point.

.4 Carry out insulation resistance test of all phases to ground and between phases of main bus work. Record results in megohms.

.5 Contact resistance if applicable.

.5 Panelboards

.1 Inspect for physical damage, proper installation, supports, and grounding.

.2 Verify that neutrals are grounded only at the main service.

.3 Load balance tests: Check all panelboards for proper load balance between phase conductors and make adjustments as necessary to bring unbalanced phases to within 15% of average load.

.4 Electronic and adjustable Breakers: provide adjustments as required to align with connected equipment.

.6 Breakers and Load Break Switches

.1 Adjust and set in accordance with power system study.

.2 Clean and lubricate.

.3 Visual inspection.

.4 Manual function test.

.5 Torque test.

.6 Contact resistant test (100 Amp resistance tester).

.7 Electrical function test.

.8 Function trip test of all protective relay device.

.7 Breakers: Molded Case Breakers 150 Amp Frame and Larger:

.1 Visually inspect.

.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:

.7 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.

.8 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instruction.

.9 If manufacturer's tester is not available, use an approved relay tester unit with proper test data and test accessories.

.10 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 relay circuit to test trip operation.

.11 Check C/T and P/T ratios and compare to coordination data.

.8 Fused or Unfused Disconnect Switches:

.1 Visually inspect and clean.

.2 Ductor test across switch blade contact surfaces.

.3 Megger test.

.4 Mechanical function test.

.9 Transformers

.1 Visual inspection of enclosure and all accessories.

.2 Torque test all bus connections and cable terminations and seal with red lacquer.

.3 Megger test.

.4 Dielectric power factor test.

.5 Core ground test.

.6 Ratio test in all tap positions.

.7 Test operation of temperature and operation of all associated alarm contacts.

.8 Test and calibrate ground fault relays and function test to trip associated breakers.

.9 Make voltage and power factor checks throughout building. If directed by the Contract Administrator, adjust transformer tap settings. Readings taken at this time to be logged, tabulated and any adjustments made to be suitably logged and incorporated in the Project Binders.

.10 Microprocessor Type Relays

.1 Mechanical Inspection:

.2 Remove cover from relay case carefully. Trip circuit is live circuit and on some relays it is possible to cause an instantaneous trip while removing relay cover. Inspect cover gasket. Check glass for tightness and cracks.

.3 Eliminate unwanted tripping, short circuit current transformer secondary by careful removal of relay test plug or operation of appropriate current blocks.

.4 Check connections, circuit boards and modules for tightness.

.5 Check output relay coils for signs of overheating and brittle insulation.

.6 Cleaning:

.1 Clean glass inside and out.

.2 Clean relay compartment as required. Clean relay plug in contacts if applicable, using proper tools.

.3 Remove dust and foreign materials from interior of relay using small brush or low pressure 3.2 kg blower of nitrogen.

.4 Inspect for any signs of moisture and corrosion.

.5 Clean relay output contacts with burnishing tool or non residue contact cleaner.

.7 Electrical Testing: Function tests for typical overcurrent relays include:

.8 Energize relay from an appropriate DC power source and check "ON" indication.

.9 Time current function test and trip flag operation.

.10 Instantaneous pickup functional trip and flag operation.

.11 Use tests listed above for most microprocessor overcurrent type relays.

.12 Check C/T and P/T ratios and compare to coordination data.

.11 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 manufacturer's tester is not available, use an approved relay tester unit with 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 relay circuit to test the trip operation.

.5 Check C/T and P/T ratios and compare to coordination data.

.12 Motor Control Centre/Panels

.1 Megger Test all motor feeders.

.2 Check polarity and verify phase relationships on main feeder and all equipment feeders. Bump Test all existing motors fed from the new MCC.

.3 Power up control circuits. Verify operation of all control circuits re-terminated at new MCC.

.4 Test operation of each piece of equipment in ‘Hand’

.5 Test operation of each piece of equipment in ‘Auto’

.6 Where required, verify shutdown of equipment on fire alarm.

.13 Bus Duct - Low Voltage

.1 Visually inspect.

.2 Torque test all bolted connections and seal with red lacquer.

.3 Megger test.

.4 Contact resistance test on total bus duct.

.14 Devices

.1 Test all receptacles for proper polarity, circuitry, and grounding.

.15 Grounding systems

.1 Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system-neutral, and/or derived neutral points installed as part of this Contract. Investigate resistance values, which exceed 0.5 ohm. If this resistance cannot be obtained with the ground system, notify the Consultant for further instruction.

.2 The resistance to ground between the equipment enclosures and the grounding grid shall be tested. In soils of low conductivity, additional ground rods, ground plates, and ground wires shall be added, as required. Ground measurements shall not exceed 25 ohms. Measurements shall be undertaken under dry soil conditions, and when frost penetration has not exceeded 150mm. Test results shall be documented by the Contractor and copies given to the Contract Administrator.

.3 Test Method: 3-Point (Fall-of-Potential) Method per IEEE Standard 81.

3.3 HVAC AND LIGHTING SYSTEMS

.1 The following applies to heating, ventilation, and lighting systems:

.1 Heating and Ventilation Systems

.1 Purpose to ensure that existing systems are functional. Verification includes:

.1 Confirmation of thermostat settings for heating and cooling.

.2 Confirmation of operation of heaters and fans.

.3 Confirmation of all control panel elements for ventilation control panels are operational and functioning.

.2 Lighting Systems

.1 Purpose to ensure that systems are functional. Verification includes:

.1 Confirmation that lighting within each building is activated by the associated switches.

.2 Confirmation that emergency lighting is operational in the event of power failure.

.3 Confirmation that enclosure lighting is operating as intended per Contract Drawings.

3.4 CONTROL SYSTEMS

.1 The following applies to control systems and instrumentation:

.1 Loop testing: Purpose is to test all control wiring loops between instrumentation and terminations within the control panel to ensure signal continuity and correct signal polarity. Loop testing to be completed for the following instruments:

.1 Flow meters

.2 Pressure transmitters

.3 Radar level transmitters

.4 RTD temperature sensors

.5 Float switches

.6 Door contacts

.7 Heat/ smoke detectors

.8 VFD signals

.9 Current transducers

.10 And any other devices included within the Contract Documents.

.2 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:

.1 Operation of pump starters (VFDs, HOA operation, etc.).

.2 Operation of control system (PLCs, HMIs, relay components, etc.).

.3 Operation of each device individually and within its environment.

.4 Operation of buttons, switches, and pilot lights.

.5 Operation of the external devices, including:

.1 Building controls (heat/ smoke/ security elements)

.2 Float switch

.3 Level sensors

.4 Flow meters

.5 Pressure Transmitters

.6 Provide assistance during Owner testing and commissioning activities.

.2 Labels

.1 Upon completion of the inspection, calibration, and testing, attach a label to all devices tested. These labels shall indicate the date tested, the Contractor company name, and tester's initials.

.3 Re-testing

.1 Any fault in material or in any part of the installation revealed by these tests shall be investigated, replaced, or repaired by the Contractor and the same test repeated by the Contractor at Contractor’s expense until no fault appears.

3.5 MANUFACTURER'S FIELD SERVICES:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit manufacturer's field reports to Contract Administrator for review. Include field reports in Project Binders.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Obtain manufacturer’s field services for commissioning of equipment as required in other Sections of Division 26 Technical Specifications.

.4 Conduct additional testing as required in other Sections in Division 26 Technical Specifications.

3.6 STANDARDS

.1 The following tests shall be conducted in accordance with latest CSA, ASTM, IEEE and IPCEA standards, recommendations for power cable and equipment testing and standards of the authority having jurisdiction. Notwithstanding the test levels listed in these standards, in no case shall the maximum DC test level exceed manufacturer's factory test AC level for that equipment.

.2 Where production tests are required by EEMAC or CSA for manufactured equipment, provide records of these tests. All tests shall be completed in accordance with manufacturer's published instructions. If these instructions do not conform to the test requirements as specified herein inform the Contract Administrator prior to proceeding with the test.

3.7 TEST APPARATUS AND INSPECTION REPORT

.1 The Contractor is responsible for furnishing all apparatus and labour required for the test operations.

.2 Inspection and test results to be recorded on a suitable form which shall be furnished by the Contractor. The inspection and report forms shall be submitted to the Contract Administrator. Each form to be signed by the test technician. Space to be provided for noting approved items and their disposition.

.3 The Contractor will submit full commissioning reports and information for as-built drawings and acceptance documents signed by test technician.

.4 Upon completion of the Work, the Contractor will assemble complete sets of inspection/test results/reports to be placed in the operating and maintenance manuals. Reports shall include the following:

.1 Summary of project

.2 Description of equipment tested

.3 Description of test

.4 Test results including re-testing results

.5 Test dates

.6 Tester’s name

.7 Witnesses (when required)

.8 Corrective work

.9 Acceptance criteria

.10 Conclusions and recommendations

.11 Appendix, including appropriate test forms

3.8 DEMONSTRATION

.1 Demonstrate and instruct the Owner's personnel on operating and maintenance procedures for all electrical systems using the assistance of specialist sub-trades and manufacturer's representatives for instruction. Systems to be demonstrated and trained on shall include the following:

.1 Entire power distribution systems (primary and backup).

.2 Operation of circuit breakers, interlocking schemes, etc.

.3 Motor control equipment and associated components.

.4 Instrumentation and field monitoring/control devices.

.5 Manual and automatic station control operation.

.6 Continuity between switches/pilot lights/field devices and the PLC.

.7 Loss of power controls and backup power operation.

.8 Alarming.

.9 Routing and installation of major feeders, grounding and raceways.

.10 Labeling and identification schemes.

.11 Use of the operations and maintenance manuals.

3.9 TRAINING

.1 Arrange an acceptable time with the Owner and the Contract Administrator and submit a program of instruction and demonstration for the Owner's approval. Assume that the Owner's staff are not familiar with any of the special equipment and/or systems installed.

.2 As a condition of Substantial Completion, submit to the Contract Administrator complete list of systems demonstrated and training completed, and state for each system:

.1 Date that instructions were given to the Owner’s staff.

.2 Duration of instruction.

.3 Names of persons instructed.

.4 Other parties present (manufacturer’s representative, Contract Administrator, etc.).

.5 Signature of the Owner’s staff stating that they properly understood the system installation, operation, and maintenance requirements and identifying any systems or equipment which were not demonstrated to their satisfaction and which must be re-demonstrated

3.10 SYSTEM ACCEPTANCES

.1 Prior to requesting inspection, submit, for review by the Contract Administrator letters from the manufacturers of equipment and systems indicating their technical service representatives have inspected and tested the equipment and systems and are satisfied with the methods of installation, connections, and operation.

.2 Such acceptance letters shall be submitted for the following:

.1 Switchboards.
.2 Distribution and Power Panels.
.3 Transformers.
.4 Motor Control Centres/Panels.
.5 Variable Frequency Drives.

END OF SECTION

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Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
P2	September 22, 2023	Issued for Tender	WW	BW
P1	August 30, 2023	Issued for Final Review	WW	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for wire and box connectors.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 21 Wires and Cables (0-1000V)

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18.1-13, Metallic Outlet Boxes

.2 CAN/CSA C22.2 No. 18.2-06, Nonmetallic Outlet Boxes

.3 CAN/CSA C22.2 No. 18.3-12, Conduit, Tubing, and Cable Fittings

.4 CAN/CSA C22.2 No. 18.4-04, Hardware for the Support of Conduit, Tubing

.5 CAN/CSA C22.2 No. 65-18, Wire Connectors.

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

.1 EEMAC 1Y 2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y 2 to consist of:

.1 Connector body and stud clamp for copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable and flexible conduit as required to comply with CAN/CSA C22.2 No. 18 (all subsections).

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 wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant or provide photographic evidence of areas of concern.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer.

Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y 2.

END SECTION

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1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 20 Wire and Box Connectors (0-1000V)

.3 Technical Specification 26 05 43 01 Installation of Cables in Trenches and Ducts

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables

.2 CAN/CSA C22.2 No. 38-14, Thermoset-insulated wires and cables

.3 CSA C22.2 No. 49, Flexible Cords and Cables

.4 CSA C22.2 No. 51, Armoured Cables

.5 CSA C22.2 No. 52, Underground secondary and service-entrance cables

.6 CSA C22.2 No. 65, Wire Connectors

.7 CAN/CSA C22.2 No. 75, Thermoplastic insulated wires

.8 CAN/CSA C22.2 No. 127-15, Equipment and lead wires

.9 CSA C22.2 No. 131, Type TECK 90 Cable

.10 CAN/CSA C22.2 No. 131-17, Type TECK 90 Cable

.11 1.4.13 CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations

.12 CSA C22.2 No. 2556, Wire and Cable Test Methods

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 POWER WIRING

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG, unless noted otherwise.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketed.

.3 Colour Code:

.1 AC 3-Phase:

.1 Line 1: Red

.2 Line 2: Black

.3 Line 3: Blue

.4 Neutral: White

.2 AC Single Phase:

.1 Hot: Black

.2 Hot (Secondary): Red

.3 Neutral: White

.4 Grounding conductors to be in accordance with requirements in Technical Specification 26 05 28 Grounding - Secondary.

2.1 TECK 90 CABLE

.1 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.2 Insulation:

.1 Cross-linked thermosetting polyethylene rated type RW90 XLPE.

.2 Rating: 1000V

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: interlocking aluminum.

.5 Overall covering: thermoplastic polyvinyl chloride.

.6 Connectors:

.1 Watertight approved for TECK Cable.

.2 Explosion proof in classified areas approved for TECK cable.

2.2 CONTROL AND INSTRUMENTATION CABLE

.1 Internal cabinet control wiring shall be TEW (tinned).

.1 Wire: to CAN/CSA C22.2 No. 127-15.

.2 Minimum Size (unless otherwise noted by Contract Drawings):

.1 120VAC: 14AWG.

.2 24VDC: 18AWG.

.3 Colour Code

.1 AC Hot: Black

.2 AC Hot (Secondary): Red

.3 AC Neutral: White

.4 DC Positive: Red

.5 DC Negative: Blue

.6 Generator Start: Yellow

.7 Ground: Green

.2 Analog instrumentation wiring:

.1 Cable: to CAN/CSA-C22.2 No. 75.

.2 Conductors:

.1 Circuit conductors: 7 strand tinned copper.

.3 Insulation:

.1 Cross-linked thermosetting polyethylene rated type RW90 XLPE.

.2 Rating: 300V and 600V, as required.

.4 Jacket: polyvinyl chloride material.

.5 Shield:

.1 Individual Foil

.2 Tinned copper drain wiring under and in contact with foil.

2.3 ETHERNET CABLES

.1 CAT6 (250MHz) rated, compatible with 1000BaseT networks.

.2 Outdoor rated, installation in conduit approved, UV resistance.

.3 Conductors:

.1 8 x 23 AWG solid copper conductors, arranged in 4 twisted pairs.

.2 RJ45 Termination: TIA 568A

.3 Straight-through (non-crossover) wiring, unless noted otherwise.

.4 Jacket:

.1 Oil and sunlight resistant PVC.

.2 Colour: Blue

2.4 ARMOURED ETHERNET CABLES

.1 CAT6 (250MHz) rated, compatible with 1000BaseT networks.

.2 Outdoor rated, installation in conduit approved, UV resistance.

.3 Conductors:

.1 8 x 23 AWG solid copper conductors, arranged in 4 twisted pairs.

.2 RJ45 Termination: TIA 568A

.3 Straight-through (non-crossover) wiring, unless noted otherwise.

.4 Jacket:

.1 Oil and sunlight resistant PVC.

.2 Colour: Blue

.5 Armour:

.1 Interlocked aluminum

2.5 ETHERNET PATCH CABLES

.1 CAT6 (250MHz) rated, compatible with 1000BaseT networks.

.2 8 x 23 AWG solid copper conductors, arranged in 4 twisted pairs.

.3 Straight-through (non-crossover) wiring, unless noted otherwise.

.4 RJ45 male connectors with molded boots.

.1 Termination: TIA 568A

.5 Colour: Blue

2.6 ARMOURED VFD CABLES

.1 Temperature range: -40 degrees Celsius to +90 degrees Celsius

.2 Voltage rating: 1000V

.3 Certification:

.1 CSA FT-4 Flame Rated

.4 Construction:

.1 Overall: 3 power wires plus 3 ground wires

.2 Conductors: fine stranded bare copper

.3 Insulation: XLPE

.4 Jacket: PVC

.5 Shielding: Overall shield and tinned copper braid

.6 Suitable for installation in underground conduit

.5 Standard of Acceptance: TEXCAN Armoured VFD Power Cable or approved equivalent.

2.7 ARMOURED CONTROL AND INSTRUMENTATION CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239-21.

.2 Conductors:

.1 Circuit conductors: 7 strand tinned copper.

.2 Conductor size per Contract Drawings.

.3 Insulation:

.1 Cross-linked thermosetting polyethylene rated type RW90 XLPE.

.2 Rating: 300V and 600V, as required.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride.

.7 Certification:

.1 FT-4 Flame Rated

.2 Temperature: 105°C dry, 75°C wet, and -40°C

.3 Suitable for installation in Class I, Zone 1 and Zone 2, and Class II, Division 1 and 2 Hazardous Locations.

.8 Connectors:

.1 Watertight approved for armoured control and instrumentation cable.

.2 Explosion proof in classified areas approved for armoured control and instrumentation cable.

2.8 TWISTED PAIR SHIELDED (TPSH) ARMOURED CABLES

.1 TPSH cables are to be constructed as follows:

.1 Compliance: CSA C22.2 - No. 38, No. 174 and No. 239

.2 Two copper conductors, stranded, tinned, minimum #16 AWG, PVC-insulated, twisted in nominal intervals of 50 mm. Conductor identification to be by black and white coloured insulation.

.3 100 percent coverage aluminum foil or tape shield and bare stranded, tinned copper drain wire, minimum #16 AWG for each pair.

.4 Separate bare stranded, tinned copper drain wire, minimum #16 AWG for each pair.

.5 Overall shield and bare stranded tinned copper drain wire for multi-pair cables.

.6 Insulated for 600 V, 90 degrees C.

.7 Interlocking aluminum armour.

.8 Overall flame-retardant PVC jacket rated to minus 40 degrees C and meeting low gas emission and FT4 flame test requirements as specified in CSA-C22.2 – No. 0.3 and IEEE 383, and sunlight (UV) resistant rated.

.9 Overall PVC jacket to be grey in colour.

.10 HL rating for hazardous location Class 1 Div. 1 or 2.

.11 Suitable for cable tray installation, indoor and outdoor, for direct burial, and for installations in conduits.

.12 Each pair of multiconductor TPSH cables to be individually shielded and continuously number coded.

2.9 TRIAD SHIELDED ARMOURED CABLES

.1 Triad shielded armoured cables constructed same as Twisted Pair Shielded cables except for:

.1 Three copper conductors per triad group.

2.10 FIBRE OPTIC CABLES

.1 Standard of acceptance: Corning ALTOS Loose Tube, Gel-Free Cable 96 F, SMF-28 ULL, Single-mode (OS2).

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Terminate cables in accordance with Technical Specification 26 05 20 Wire and Box Connectors - (0-1000 V).

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 All field wiring/communication cabling that maybe field installed directly onto any cabinet door mounted components shall be suitably routed and protected across the door hinge to prevent possible mechanical damage upon door opening and/or door closing.

3.3 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of cable.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 Wire Labeling:

.1 Low voltage single and three phase power conductors shall be tagged with the following format: XXXX-X#, where:

.1 XXXX – Equipment tag number that is being supplied

.2 -X – L (for phase conductors) or N (for Neutral)

.3 # - Sequential Number, if necessary.

.4 Examples:

.1 VFD301-L1: VFD301 power conductor (red phase)

.2 VFD301-L2: VFD301 power conductor (black phase)

.3 VFD301-L3: VFD301 power conductor (blue phase)

.4 [REV]-L: Single-phase Pump 1 line conductor

.5 [REV]-N: Single-phase Pump 1 neutral conductor

.2 Field instrument and control wires shall be tagged with the following format: XXX###-XX##, where:

.1 XXX### – Field equipment tag number

.2 –XX## – Sequential Number or Voltage Identifier

.3 Examples:

.1 FIT110-2: Instrument field wiring to Flow Indicator Transmitter 110

.2 LSH003-1: Field control wire from Level Switch LSH003

.3 Panel wiring shall be tagged with the following format: XXX###-##XXX, where:

.1 XXX### – Upstream equipment tag

.2 –##XXX – PLC channel identifier, or Voltage Identifier and sequential number

.3 Panel wiring suffixes (xxx):

.1 24V – 24VDC Control Supply

.2 12V – 12VDC Control Supply

.3 0V – ELV return wire

.4 GND/SHD – Field instrument wire ground (or shield)

.5 AI+/AI- - Analog Signal wiring (control panel terminal to PLC/RTU)

.6 DI – Digital Input wiring (control panel terminal to PLC/RTU)

.7 DO – Digital output wiring (control panel terminal to PLC/RTU)

.4 Examples:

.1 LCP101-24V13: 24VDC supply wire in Local Control Panel 101

.2 PLC101-03AI+: Analog input signal wiring to PLC101, Channel 3

.3 RTU801-02DI: Digital (discrete) input signal wiring to RTU801, Channel 2

3.4 ANALOG SIGNALS

.1 Use twisted-pair shielded armoured (instrument TECK cable) as applicable, for low-level analog signals such as 4-20 mA, 1-5VDC, 0-10VDC, pulse type circuits 24VDC and under, and other signals of a similar nature.

.2 Use triad shielded armoured cable for connections between RTDs and transmitters or CDAC RTD inputs.

3.5 DIGITAL SIGNALS

.1 Use TPSH armoured cable for input and output signals 24 VDC and under and terminate in the marshalling panels.

.2 Use Control TECK cable or wire and conduit power to instruments, for 120 V signals other than those mentioned above and as otherwise shown in the Contract Drawings.

3.6 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

3.7 INSTALLATION OF TECK90 CABLE (0-1000V)

.1 Install cabling as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Install cable exposed, securely supported by straps or hangers.

.1 Group cables wherever possible on channels, individually strapped.

3.8 INSTALLATION OF ARMOURED CABLE

.1 Install cabling as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Install cable exposed, securely supported by straps or hangers.

.1 Group cables wherever possible on channels.

3.9 INSTALLATION OF CONTROL AND INSTRUMENTATION CABLE

.1 Ground control cable shield at control cabinet only.

.2 Cut and heatshrink shield at terminations to field devices.

3.10 INSTALLATION OF ARMOURED VFD CABLE

.1 Install cabling per manufacturer’s directions and as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Install cable exposed, securely supported by straps or hangers.

.1 Group cables wherever possible on channels.

.3 Terminate cables with connectors as specified by the cable manufacturer and in accordance with Section 26 05 20 – Wire and Box Connectors (0-1000V).

.4 Ground cable as indicated by cable and variable frequency drive manufacturer’s directions.

3.11 INSTALLATION OF ARMOURED CONTROL AND INSTRUMENTATION CABLE

.1 Install cabling as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Install cable exposed, securely supported by straps or hangers.

.1 Group cables wherever possible on channels.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for secondary grounding.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 CSA C22.1 - Canadian Electrical Code, Part 1: Section 10 Grounding and Bonding

.2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-02, Qualifying Permanent Connections Used in Substation Grounding.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 EQUIPMENT

.1 Rod electrodes: copper clad steel, 19mm dia. by 3 m long.

.2 Plate electrodes: copper surface area minimum 0.2 m^3, 1.5mm thick, in accordance with the CEC.

.3 Grounding conductors: medium hard drawn, 7 strand, bare stranded copper, sized as indicated on Contract Drawings.

.4 Insulated grounding conductors: green, sized as indicated.

.5 Ground bus: copper, sized as indicated, complete with insulated supports, fastenings, connectors.

.6 Grounding rod inspection well:

.1 High density polyethylene construction

.2 Minimum 250mm top opening.

.3 Bolt down cover with skid resistant surface.

.7 Non corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Bonding jumpers, straps.

.5 Pressure wire connectors.

Part 3 Execution

3.1 GENERAL INSTALLATION

.1 Install exterior buried grounding loop system as indicated on the Contract Drawings.

.2 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end.

3.2 INSPECTION WELL

.1 Install grounding stud, electrode, size as indicated stranded copper conductor in each inspection well as indicated on Contract Drawings.

.2 Install ground rod in each inspection well so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements (25 Ohms).

3.3 ELECTRODES

.1 Install rod electrodes and make grounding connections within inspection wells.

.2 Bond separate, combine multiple electrodes together, if separate.

.3 Size copper conductors for connections to electrodes, sized as indicated on Contract Drawings.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral secondary 120V system.

3.5 EQUIPMENT GROUNDING

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

3.6 JUNCTION BOXES AND VAULTS

.1 Bond lids of in-ground junction boxes and vaults.

3.7 MASTER GROUND BUS

.1 Install copper grounding bus mounted on insulated supports inside P291 pump station.

.2 Ground items of electrical equipment in pump station to ground bus with individual copper connections, sized as indicated on the Contract Drawings.

.3 Ground items of water system to ground bus with copper connections, sized as indicated on the Contract Drawings.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results – Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and Government Authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with the Contract Documents.

1.1 SCOPE

.1 Materials and installation for hangers and supports for electrical systems.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 02 Seismic Restraint

1.3 REGULATORY REQUIREMENTS

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-02, Qualifying Permanent Connections Used in Substation Grounding.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SUPPORT CHANNELS AND STANCHIONS

.1 Select channel as indicated in the Contract Drawings:

.1 U shape, stainless steel, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended with stainless steel hardware.

.2 All materials to assemble stanchions shall be from same manufacturer.

.2 Wire and cable ties: nylon ‘Ty-rap’ or approved equal for wiring and control cable. Velcro cable wraps for data cables.

Part 3 Execution

3.1 INSTALLATION

.1 Refer to Technical Specification 26 05 02 – Seismic Restraint.

.2 Contractor to note that the intent of this Technical Specification is for the Contractor to provide under the base contract all seismic restraint of electrical equipment.

.3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

- .1 One-hole stainless steel straps to secure surface conduits and cables 53 mm and smaller.
- .2 Two-hole stainless steel straps for conduits and cables larger than 53 mm.

.4 For surface mounting of two or more conduits use channels at 1500 mm on centre spacing.

.5 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.6 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.7 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.8 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.9 Install fastenings and supports as required for each type of equipment cable and conduit in accordance with manufacturer's installation recommendations.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for splitters, junction, pull boxes, and cabinets.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings

.3 Technical Specifications 26 27 16 Electrical Cabinets and Enclosures

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 CSA C22.2 No. 76, Splitters.

.3 CSA-C22.2 No. 85, Rigid PVC Boxes and Fittings.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SPLITTERS

.1 Not used.

2.1 CONCRETE JUNCTION BOXES

.1 Standard of acceptance: AE Concrete Type 5686 and B937 where indicated on Contract Drawings.

2.2 JUNCTION AND PULL BOXES

.1 RPVC construction sized to suit. Screw on flat covers. All mounting hardware to be stainless steel.

.2 Internal dielectric barrier for separating controls and power terminations only where indicated on Contract Drawings.

2.3 EXPLOSION PROOF JUNCTION BOXES

.1 Not used.

2.4 TERMINAL AND PULL BOXES

.1 Intended for surface mounting, except as otherwise specified.

.2 Weatherproof, Style WP1

.1 Copper-free cast aluminum, Type 4.

.2 Hinged door if any one dimension exceeds 300 mm.

.3 Manufactured breather, designed to maintain weatherproof classification of enclosure.

.4 When used as terminal box, equipped with mounting pan and terminal strip.

.3 Weatherproof, Style WP2

.1 Same features as for Style WP1, except made of sheet aluminum, minimum 2.3 mm thick.

.2 Dripshield.

.4 Weather- and Corrosion-Proof, Style WP3

.1 Same features as for Style WP1, except Type 4X enclosure, made of 316 stainless steel.

.5 Weather- and Corrosion-Proof, Style WP4

.1 Same features as for Style WP1, except non-metallic, Type 4X fibreglass enclosure.

.2 Quick-release latches.

.6 Indoor Dry Location Non-process Area, Style GP5

.1 Welded steel or aluminum Type 12 enclosure.

.2 Hinged cover with quick-release latch or automotive handle, for enclosures that exceed 300 mm in width or height.

.7 Watertight, Style WT

.1 Same as weatherproof styles WP1 to WP 4, except without breather.

.2 Explosion-proof, Style XP

.3 Same features as for Style WP1, except, in addition to being weatherproof, also suitable for the hazardous location specified.

2.5 CABINETS

.1 Intended for surface mounting, except as otherwise specified.

.2 Enclosure rating is to be the higher rating of the rating shown in the drawings and the rating based upon location of installation.

.3 Single - or double-door construction with 316 stainless steel full-length hinge.

.4 Minimum standard: formed and welded Type 12 construction, of minimum 1.8 mm thick sheet steel, with automotive door handle.

.5 For process and outdoor areas: formed and welded Type 4X construction of minimum 2 mm thick sheet aluminum, with 316 stainless steel door clamps and hardware.

.6 Full-size equipment mounting pan of formed sheet metal.

Part 3 Execution

3.0 SPLITTERS

.1 Not used.

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Type B937 concrete junction boxes installed per MMCD standard detail drawing E2.2 and Type 5686 concrete junction boxes installed per MMCD standard detail drawings E2.3 and E2.4.

.3 Mount cabinets with top not higher than 2 m above finished floor, unless otherwise indicated.

.4 Install equipment and terminal blocks as indicated in cabinets.

.5 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for outlet boxes, conduit boxes, and fittings.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 240V outlet boxes for 240V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 Provide clear while-in-use gasketed cover for interior outlets, where indicated in Contract Drawings.

2.1 CONDUIT BOXES

.1 FD NEMA 4X RPVC boxes with factory-threaded hubs, mounting feet, and gasketed covers, where indicated in Contract Drawings.

.2 Provide clear while-in-use gasketed cover for interior outlets, where indicated in Contract Drawings.

2.2 WEATHER-PROOF OUTLET BOXES

.1 RPVC boxes for outlets rated for outdoor environments.

.2 Connected to TECK 90 cables as required, minimum size 102 x 54 x 48 mm.

.3 Provide weatherproof clear lockable while-in-use covers for all GFI locations, where indicated.

2.3 HAZARDOUS AREA OUTLET BOXES

.1 Not used.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

Part 3 Execution

3.0 INSTALLATION

.1 Recess mount lighting and outlet boxes located on building exterior.

.2 Surface mount boxes located in building interior.

.3 Support boxes independently of connecting conduits.

.4 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of the work.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.6 Vacuum clean interior of outlet boxes before installation of wiring devices.

3.1 IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

.2 Install identification labels indicating circuit, voltage, and phase.

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Part 1 General

1.0 DOCUMENTS

.1 This Section of the Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for conduits, conduit fastenings and conduit fittings.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 21 Wires and Cables (0-1000V)

.3 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 CAN/CSA C22.2 No.18.3 12, Conduit, Tubing, and Cable Fittings

.3 CAN/CSA C22.2 No.18.4-04, Hardware for the Support of Conduit, Tubing and Cable

.4 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit.

.5 CSA C22.2 No. 45.2-08, Electrical Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel.

.6 CSA C22.2 No. 83-M1985 – Electrical Metallic Tubing

.7 CSA C22.2 No. 211.2 06, Rigid PVC (Unplasticized) Conduit.

.8 CAN/CSA C22.2 No. 227.2.1-04, Liquid Tight Flexible Nonmetallic Conduit.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 CONDUITS

.1 Rigid aluminum conduit: to CSA C22.2 No. 45.2.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.2.1.

2.1 CONDUIT FASTENINGS

.1 One hole stainless steel straps to secure surface conduits 53 mm and smaller. Two hole stainless steel straps for conduits larger than 53 mm.

.2 Seismic beam clamps to secure conduits and supports to exposed steel work.

.3 Channel type supports for two or more conduits at 1500 mm oc.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

.5 All conduit fastenings and supports shall be stainless steel.

2.2 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "elbows" where 90 degree bends are required for 27 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.3 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.4 HAZARDOUS AREA CONDUIT SEALS

.1 Not used.

2.5 PULL CORD

.1 Polypropylene

.1 Minimum tensile strength of 1.1kN.

.2 Mildew and rot resistant.

Part 3 Execution

3.0 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Use rigid PVC conduit underground.

.3 Use liquid tight flexible metal conduit for connection to devices, motors, or vibrating equipment, with the exception of connections made using armoured cable.

.4 Minimum conduit size for lighting and power circuits: 21mm

.5 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.6 Mechanically bend steel conduit over 21 mm diameter.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Install polypropylene fish cord in empty conduits.

.9 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.10 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended or surface channels.

.3 Do not pass conduits through structural members except as indicated.

3.3 UNDERGROUND CONDUITS

.1 Refer to Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts for installation of cable procedures.

.2 The Contractor shall provide and install all necessary bends, couplings, reducers, bell end fittings, plugs, caps and adaptors of the same product material as the conduit to ensure a complete installation.

.3 All conduits shall drain towards junction boxes. Spacing between power and communications conduits for longitudinal runs shall be 300mm (unless concrete encased). The spacing may be reduced to 50mm at crossover points and where the conduits enter and exit junction boxes and pull pits.

.4 The Contractor shall not use any factory bends in the conduit runs except where shown on the Contract Drawings or as approved by the Contract Administrator. Where factory 90 degree bends are approved, the radius shall be greater than 900mm.

.5 All conduits shall be verified and cleaned using the following procedure:

.1 To verify integrity of conduit, pull through each conduit duct a hard rubber mandrel, not less than 300mm long and of a diameter 6mm less than the internal diameter of the duct, preceded by a swab of suitable diameter to remove sand, earth and other foreign materials.

.2 Notify Contract Administrator in the event of conduit failure.

.3 Clean ducts before laying. Cap both ends during Construction and after installation to prevent entry of any foreign materials.

.4 Install pull line.

.5 Terminate conduit ends in the junction box.

.6 Clean and vacuum junction boxes.

.7 Locations shall be laid out by the Contractor and field reviewed by the Contract Administrator prior to installation.

.6 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

.7 Trench Markers:

.1 Concrete type cable markers: Minimum 600 mm x 600 mm x 100 mm, with words: "cable," "conduit," or additional circuit identification if so directed by Engineer, impressed in top surface, with arrows to indicate change in direction of conduit runs.

.8 Warning Tape:

.1 Detectable by a pipe/cable locator or metal detector from above the undisturbed ground.

.2 Minimum 50 mm wide with an aluminum foil core laminated between two layers of 3.5 mil thickness polyester plastic.

.3 Plastic colour coding: red for electrical lines, orange for telephone lines, and orange for optic fibre cables.

.4 Imprint a warning continuously along the length, with message reading similar to: "CAUTION – BURIED ELECTRIC (TELEPHONE) LINE BELOW".

.9 Conduit Spacers:

.1 Preformed, rigid plastic spacers designed for direct burial and concrete encasement.

.2 Base and intermediate spacers to suit conduit trade size.

.3 Snap feature or non-metallic ties to obtain required configuration.

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Part 1 General

1.0 DOCUMENTS

.1 This Section of the Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for cable trays for electrical systems.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

- .1 CAN/CSA C22.1 No.126.1, Metal Cable Tray Systems.
- .2 CAN/CSA C22.1 No.126.2, Non Metallic Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

- .1 NEMA FG 1, Fibreglass and Cable Tray Systems.
- .2 NEMA VE 1, Metal Cable Tray Systems.
- .3 NEMA VE 2, Cable Tray Installation Guidelines.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Quality assurance submittals:

- .1 Test reports: submit certified test reports.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 CABLE TRAY

.1 Cable tray shall meet specified NEMA/CSA load ratings with safety factor of 1.5. As a minimum the cable tray shall support 67 kg/m over 6 metre as per CSA load class D/6m in CSA C22.2 No. 126.1.

.2 Copper-free aluminum tray, 150 mm, 300 mm, 450 mm, 600 mm, and 750 mm wide as indicated with a minimum depth of 100 mm, and rungs spaced maximum 300 mm, unless noted otherwise on the Drawings.

.3 Splice plates shall be the bolted type, made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed 0.00033 ohm. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray. Splice plates shall be made of 6063-T6 aluminum, using four square neck carriage bolts and serrated flange locknuts.

.4 Horizontal elbows, end plates, dropouts, vertical risers and drops, tees, wyes, expansion joints, and reducers where required. Fittings: manufactured accessories for cable tray supplied. Radii on fittings: 900 mm for power tray for cables above 5kV, 600 mm minimum for all other trays, unless otherwise noted.

.5 In corrosive areas use copper-free aluminum, type 316 stainless steel, or fiberglass ventilated ladder type cable tray.

.6 Instrumentation and digital communication cables shall be routed in either barriered or separate instrumentation cable tray systems.

.7 Provide barriers to separate 600 V power and control cables from instrument analog cables when these cables are installed in the same cable tray.

.8 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.

.9 Provide fire stop material at firewall penetrations.

.10 Outdoor cable trays shall have covers for UV protection of cable jackets. Cable tray covers to be solid aluminum covers with a flange and c/w raised cover clips.

.11 Cable derating is required unless spacing is maintained as per CEC 12-2210.

2.1 CABLE SPACERS

.1 Where single conductor feeders or MCC feeder cables are specified, provide Maplewood spacing blocks, paraffin impregnated or painted with glyptol.

.2 Maintained spacing as specified on drawings.

.3 Diameter of opening to be suitable for cable size.

.4 Mounting hardware to be compatible with tray system.

.5 Cables, especially spaced cables to be tied down with adequate Ty-raps. Cable ties to be listed for use outdoor with UV-stabilized material.

.6 Spacing to be no greater than 900 mm.

2.2 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

.2 Ensure cable tray is supported as per manufacturer's recommendations and applicable CSA standards.

Part 3 Execution

3.0 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.1 INSTALLATION

.1 Install complete cable tray system in accordance with NEMA VE 2.

.2 Support cable tray on both sides and spaced as specified by the manufacturer.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLE TRAY

.1 Install cable rollers in cable trays to assist in the installation of cables into the cable tray.

.2 Before cable installation in trays, obtain from the cable manufacturer the maximum allowed cable pulling tensions.

.3 Lay cables into cable tray so as to provide a minimum of cable crossovers.

.4 Space cables as specified in the design documents. Do not over space the cables, so that other cables may be installed in the trays.

.5 Secure cables, in vertical cable tray only, at 3 m centres (maximum) with nylon ties and at 6 m centres in horizontal cable tray, except spaced cables shall be secured at 3m intervals.

.6 Cables are to exit from the sides of cable trays wherever possible, and not through the tray rungs, so as to permit the future addition of cable trays above and below cable trays.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 28 Grounding – Secondary

1.2 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

1.3 SCOPE

.1 Installation of cables in trenches and in ducts.

.1 Wherever the term “duct” appears, it also applies equally to conduit; similarly, the term “cable” also means wires and conductors.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 NOT USED

Part 3 Execution

3.0 CABLE INSTALLATION IN DUCTS

.1 Install cables in ducts as indicated in Contract Drawings.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 Install instrumentation (4-20ma analog) cables in separate ducts from other cables as specified in the Contract Drawings.

.6 Install digital communication cables in separate ducts from other cables as specified in the Contract Drawings.

.7 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.8 Allow extra length of cable in loop form at splice boxes, pullpits and manholes as per good trade practice.

.9 Leave a pull rope in each conduit after installation of cables to permit installation of additional cables after the completion of the Work.

.10 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.11 After installation of cables, seal duct ends with duct sealing compound.

.12 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage, installation instructions, and datasheets.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of fractional horsepower motors.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

- .1 CSA C22.2 No. 100, Motors and Generators.
- .2 CSA C22.2 No. 145, Motors and Generators for Use in Hazardous Locations.

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

- .1 EEMAC M1-7, Standard for Motors and Generators.

.3 NEMA Std. MG1. Motors and Generators.

.4 IEEE Std 114. IEEE Standard Test Procedure for Single-Phase Induction Motors

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 PERFORMANCE AND DESIGN CRITERIA

.1 General:

.1 Motors are to be approved and bear CSA labels or similar certification marks or labels that are acceptable to Technical Safety BC.

.2 Unless otherwise specified, motors 1/3 hp and smaller to be squirrel cage, single-phase, capacitor start, induction run type.

.3 Construction features listed in this Section may be as normally supplied by the equipment manufacturer.

.4 Service factor of 1.15 at 40 degrees C ambient, Class F insulation and non-hygroscopic windings, Class B temperature rise unless otherwise specified.

.5 Provide copper rotor material and copper windings.

.6 Motor nameplate shall be engraved or stamped 316 stainless steel. Information shall include those items enumerated in NEMA Standard MG1, as applicable. Nameplate shall be permanently fastened to the motor frame and shall be visibly positioned for inspection.

.7 Provide corrosion resistant hardware.

.8 Motors shall include integral overload and overheating protection per CSA Section 28 or shall include an external motor starter installed as required to provide overload and overheating protection.

.2 Rating:

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

.2 Unless specified otherwise, for valve actuators and for special applications, motors to be rated for operation at 115VAC / 1PH / 60Hz.

.3 Motors shall be approved and listed with CSA certification for environments installed. This also includes classification, division, and surface temperature markings for hazardous locations.

.4 Motors are capable of starting and running continually when the terminal voltage is from +10 percent to -10 percent of nameplate voltage.

.3 Enclosures

.1 Unless otherwise specified, provide motors with totally enclosed fan cooled or totally enclosed non-ventilated enclosures.

.2 Provide explosion-proof motors marked or labeled for Class I, Division 1, Group D hazardous locations by CSA or a similar certification agency that is acceptable to Technical Safety BC.

.3 Provide an over-temperature device in the enclosure to detect and automatically de-energize the motor.

.4 Connection Boxes:

.1 Provide explosion proof conduit box for explosion proof motors.

.2 Provide a grounding lug within the box for a cable or raceway ground connection.

.3 Boxes shall be designed to rotate in order to permit installation in any of four position 90 degrees apart.

.4 Provide oversized boxes, a minimum of one size larger than standard.

.5 Connection box shall be copper-free aluminum or approved equal for process areas.

.4 Service and Operating Conditions:

.1 Unless specified otherwise, provide motors suitable for continuous operation at an elevation of 300 m above sea level.

.2 Motors installation location shall be suitable for environmental conditions.

.3 Motors shall be rated for project site condition as specified in Technical Specification 26 05 00 Common Work Results - Electrical

.4 Motor shall de-energize upon the loss of a single phase of a three phase power supply.

.5 Motor shall de-energize within 8 seconds in the event such as a stall or jam equipment.

Part 3 Execution

3.0 INSTALLATION

.1 Install motors and valve actuators per manufacturer’s instructions.

.2 Dry out motor if dampness present in accordance with manufacturer's instructions.

.3 Make wiring connections per manufacturer’s recommendations. Include connections for:

.1 Power

.2 Pump Monitoring Sensors

.3 Exhaust system and muffler model and type.

.4 Check for correct direction of rotation.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of motors from 0.746kW to 149kW.

1.2 RELATED TECHNICAL SPECIFICATION

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 100, Motors and Generators.

.2 CSA C22.2 No. 145, Motors and Generators for Use in Hazardous Locations.

.2 National Electrical Manufacturers' Association (NEMA)

.1 NEMA MG 1-2016, Motors and Generators.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 REGULATORY REQUIREMENTS

.1 Motors are to be approved and bear CSA labels or similar certification marks or labels that are acceptable to Technical Safety BC.

.2 Motor Efficiency

.1 Motors to meet or exceed efficiency specified in the Energy Efficiency Act, Energy Efficiency Standards Regulation, B.C. Reg. 389/93 and Canada's Energy Efficiency Act and Ministry of Natural Resources Canada (NRCan) Energy Efficiency Regulations.

.2 Test motor efficiency as specified in CSA C390.

2.1 DESIGN CRITERIA

.1 Rating:

.1 Motors to be 600VAC, 3-phase, 60Hz unless otherwise specified.

.2 Motors are capable of starting and running continually when the terminal voltage is from +10 percent to -10 percent of nameplate voltage.

.3 Motor to be rated no smaller than the hp rating specified on the Contract Drawings unless approved by the Engineer after review of complete documentation submitted by the Contractor.

.4 Motors to be invertor duty rated per NEMA MG1 Part 31.

2.2 CONFIGURATION, COMPONENTS AND FEATURES

.1 Boxes

.1 Provided oversized motor terminal boxes, sized one size larger than standard as a minimum, diagonally split and gasketed complete with threaded hub for conduit or Teck cable entry. Provide NEMA 4 terminal boxes for ODP and TEFC motors. Provide NEMA 7 terminal boxes for explosion-proof motors. Motor conductors in terminal boxes to be connected to R90 compression lug connectors.

.2 Provide a grounding lug located within the box for the cable or raceway ground connection.

.3 Provide separate conduit boxes for temperature devices and space heaters.

.2 Space Heaters

.1 Where specified, furnish motors with space heaters to prevent condensation inside the motor enclosure after motor shutdown and maintain the temperature of the winding at not less than 5-degree C above outside ambient temperature.

.3 Motor Over-Temperature Protection

.1 Provide stator winding over-temperature protection on motors rated 60 hp and larger. Motors rated less than 60 hp to have stator winding over-temperature protection where indicated by the Contract Drawings or if recommended by the driven equipment manufacturer.

.2 When specified as single-phase motor, provide with over temperature device in motor enclosure to detect and automatically de-energize the motor. Device shall self-reset after the motor cools.

Part 3 Execution

3.0 INSTALLATION

.1 Install motors and valve actuators per manufacturer’s instructions.

.2 Dry out motor if dampness present in accordance with manufacturer's instructions.

.3 Make wiring connections per manufacturer’s recommendations. Include connections for:

.1 Power

.2 Over-temperature protection

.4 Check for correct direction of rotation.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of low voltage lighting control devices.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 184.1, Solid-State Dimming Controls (Bi-national standard with UL 1472 updates).

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 OCCUPANCY SENSORS

.1 Note used.

2.1 DAYLIGHT SENSORS

.1 Provide photoelectric cell for control of external lighting fixtures.

.2 Photocell to include shield for weather and glare.

2.2 DIMMING

.1 Not used.

2.3 MANUAL ON/OFF SWITCHING

.1 Individual switches ganged as indicated.

.2 Single or double pole, single or double throw as required to suit switching shown on drawings.

.3 Load rating of device shall be sufficient for size and type of lighting load being switched.

.4 Provide additional control contactors or relays for multi-circuit switching as required.

.5 Key operated where shown on Contract Drawings

.6 Motor rated where shown controlling motor circuit.

.7 Decora style commercial grade. Provide complete with cover plate. Refer to Technical Specification 26 27 26 Wiring Devices for cover plate requirements.

Part 3 Execution

3.0 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.1 INSTALLATION

.1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

.2 Where lighting control devices are to be located in close proximity, they shall be ganged with a common device box and cover plate, with voltage barriers as required.

3.2 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of transformers.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C9-02, Dry-Type Transformers

.2 CAN/CSA-C22.2 No. 47-13, Air-cooled Transformers (Dry Type)

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 PRINCIPAL TRANSFORMER

.1 Use transformers of one manufacturer throughout the Project and in accordance with CAN/CSA C22.2 No. 47 and CSA C9.

.2 Design:

.1 Rating: As indicated on Contract Drawings.

.2 Configuration: As indicated on Contract Drawings.

.3 Type: ANN.

.4 Windings: Copper

.5 Voltage taps:

.1 Primary: 2.5%, 2 – FCAN, 2 – FCBN

.2 Secondary: Not Required

.6 Insulation: Class 220º C, 130 º C temperature rise

.7 Basic Insulation Level (BIL): standard

.8 Hipot: standard

.9 Average sound level: standard

.10 Impedance at 170ºC: standard

2.1 CONTROL TRANSFORMER

.1 Use transformers of one manufacturer throughout the Project and in accordance with CAN/CSA C22.2 No. 47 and CSA C9.

.2 Design:

.1 Rating: As indicated on Contract Drawings.

.2 Configuration: As indicated on Contract Drawings.

.3 Panel mount.

.4 Molded terminal blocks for primary and secondary connections.

.5 Windings: Copper

.6 Voltage taps: standard

.7 Fuse holders for primary fuses to be finger safe fuse holders with full barriers between fuses.

.8 Fuse holder for secondary fuse to be indicating type (terminal block style) and mounted in the interior of the compartment.

.9 Insulation: Class 130º C, 80º C temperature rise

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results for Electrical.

.2 Label size: 7.

.3 Nameplate shall include equipment name, transformer kVA, primary and secondary voltage, upstream distribution panel and circuit.

.1 Confirm nameplate wording with Consultant prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Principal transformer and VFD control transformers to be internal to MCC lineup.

.2 Mount dry type transformer as indicated in Contract Drawings.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with manufacturer's wiring diagram.

.8 Energize transformers after installation is complete.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of transient voltage surge suppression (i.e. surge protection device).

1.2 RELATED TECHNICAL SPECIFICATION

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SURGE PROTECTION DEVICE

.1 Provide for transient voltage surge suppression as indicated on Contract Drawings.

.2 Short Circuit Current Ratings: 200kA

.3 Surge Capacity Rating:

.1 Service Entrance (347/600V) – 200kA per Phase (min.)

.2 Service Entrance (120/208V) – 100kA per phase (min.)

.3 Service Entrance (120/240V) – 50kA per phase (min.)

.4 One (1) form C (NO/NC) dry relay alarm output contacts.

.5 Direct bus mounted.

.6 Standard of acceptance: same manufacturer as panelboard.

2.1 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results for Electrical.

.2 Label size: 2.

.3 Nameplate shall include equipment name, voltage, and phase.

.1 Confirm nameplate wording with Contract Administrator prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Surge protection device integral to panelboard.

.2 Install conductors between suppressor and point of attachment to service equipment sized in accordance with manufacturer's shop drawings and keep conductor lengths as short as possible, not to exceed 600 mm. Provide information from manufacturers who offer an integrated surge protection device in the main service entrance equipment clearly showing lead lengths, including the neutral and ground connections.

.3 Grounding: bond suppressor ground to the equipment grounding conductor and service entrance ground.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of panelboards and circuit breakers.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 28 16 02 Molded Case Circuit Breakers

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 29-11, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 PANELBOARDS

.1 Panelboards based on CSA C22.2 No. 29.

.2 Product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.3 Bus and breakers rated as indicated on the Contract Drawings. Symmetrical interrupting capacity as indicated on Contract Drawings but not less than 10kA.

.4 Sequence phase bussing with odd numbered breakers on the left and even numbered breakers on the right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Minimum of 2 flush locks for each panelboard.

.7 Two keys for each panelboard and key panelboards alike.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Mains: suitable for bolt-on breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked grey enamel.

.12 Isolated ground bus.

.13 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

.14 Provide minimum additional space for future breakers in panelboards as follows:

.1 Panelboards 120/208V, up to 225A: minimum 10% space and 10% spare 15A breakers or as noted on the Contract Drawings

.2 Distribution boards greater than 208V: minimum 20% or as noted on the Contract Drawings

2.1 BREAKERS

.1 Breakers: in accordance with Technical Specification 26 28 16 02 Molded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker (where applicable): separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results for Electrical.

.2 Label size: 2.

.3 Nameplate shall include equipment name, voltage, and phase.

.1 Confirm nameplate wording with Contract Administrator prior to manufacture.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.0 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Technical Specification 26 05 00 Common Work Results – Electrical or as indicated on Contract Drawings.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for motor control centres.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Technical Specification 26 29 23 11 Variable Frequency Drive.

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA)

.2 CAN/CSA-Q9000, Quality Management and Quality Assurance Standards - Guidelines for Selection and Use.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SUPPLY CHARACTERISTICS

.1 As indicated on Contract Drawings.

2.1 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Main breaker integral to MCC lineup.

.3 Floor mounting, free standing, enclosed dead front.

.4 CSA Type 1 gasketed.

.5 Sections to allow for bottom and top cable entry.

2.2 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, as indicated.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Incoming cables to enter at bottom into wireway with terminals as indicated.

.8 Removable lifting means.

.9 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.10 Shipment to site, as indicated complete with hardware and instructions for assembly and installation.

2.3 SILLS

.1 Continuous channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.4 BUSBARS

.1 Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars in separate compartment self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: 600 A (100%) as indicated on Contract Drawings.

.2 Branch vertical busbars: 400 A (100%) as indicated on Contract Drawings.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current of 42 kA rms symmetrical, minimum.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.5 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

.2 Rating: As indicated on Contract Drawings.

.3 Vertical Ground Bus Type: Plug-in Zinc Plated Steel.

2.6 CIRCUIT BREAKERS

.1 Refer to Technical Specification 26 28 16 02 – Molded Case Circuit Breakers.

2.7 120/208V PANEL

.1 Provide 120/208V integrated panelboard as indicated in Contract Drawings.

.2 Refer to Technical Specifications 26 24 16 01 - Panelboards Breaker Type.

2.8 TRANSFER SWITCH SECTION

.1 Not used.

2.9 SURGE PROTECTION DEVICE

.1 Provide for surge protection device as indicated on the Contract Drawings.

.2 Short Circuit Current Ratings:

.1 Service Entrance – 100kA per Phase

.3 Ensure SPD includes disconnecting means and can be removed without shutting down entire MCC lineup.

.4 Standard of acceptance: same manufacturer as MCC.

2.10 VARIABLE FREQUENCY DRIVES

.1 Refer to Technical Specification 26 29 23 11 - Variable Frequency Drive.

2.11 STARTER UNIT COMPARTMENTS

.1 Units size as required, circuit breaker in units with lock-out provision. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for padlock to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Devices and components by one manufacturer to facilitate maintenance.

.7 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

.8 Provide control transformers as required.

2.12 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical.

2.13 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical.

.1 Motor control centre main nameplate: size No. 7, engraved as indicated.

.2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.14 FINISHES

.1 Apply finishes in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical.

.2 Motor control centre exterior colour: ASA-61 Grey.

.3 Motor control centre interior panels: White.

2.15 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Refer to Technical Specification 26 05 10 Testing and Commissioning.

Part 3 Execution

3.0 INSTALLATION

.1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.2 Make field power and control connections as indicated on Contract Drawings.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 - Testing and Commissioning.

END SECTION

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for equipment and components housed in cabinets and enclosures.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 10 Testing and Commissioning

.3 Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets

.4 Technical Specification 26 28 16 02 Molded Case Circuit Breakers

.5 Technical Specification 26 29 03 Control Devices

.6 Technical Specification 26 50 00 Lighting

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 C22.2 No. 94.1-15 (R2020) - Enclosures for electrical equipment, non-environmental considerations

.3 C22.2 No. 94.2:20 - Enclosures for electrical equipment, environmental considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 CONTROLS CABINET (CP-1)

.1 Construction:

.1 Outdoor enclosures shall be fabricated from marine grade aluminum. Steel enclosures are acceptable for indoor areas.

.2 Enclosures shall be rigid, wall or pole mounted. Outdoor enclosures shall be rated NEMA 3R. NEMA 1 is acceptable for indoor enclosures.

.3 Smooth, continuously welded seams without knockouts, cutouts, or holes.

.4 Welded brackets for enclosure mounting.

.5 Formed lip on door and enclosure to prevent ingress of flowing liquids and contaminants.

.6 Continuously hinged door with provision for removal by pulling hinge pin.

.7 Door secured with multi-point latch system including provision for padlocking.

.8 Permanently secured continuous gasket around door.

.9 Removable inner back and side panels, as required.

.10 Bonding studs on door, enclosure, and panels.

.11 Grounding and Bonding lugs, as required.

.12 Literature pocket located on inside of door.

.13 Heating and ventilation per the Contract Drawings.

.2 Finish:

.1 Door and enclosure shall be finished in recoatable smooth ANSI 61 gray powder coating inside and out.

.2 Inner panels shall be finished with white powder coating.

.3 Enclosure dimensions on Contract Drawings are approximate only. Contractor to determine final enclosure dimensions to layout all of proposed equipment.

.4 Control panel shall include provision for 20 percent future expansion.

.5 All enclosure assemblies shall be from the same manufacturer, shall bear the CSA seal of approval for the complete assembly, or other certification mark acceptable in the Province of British Columbia, and be manufactured by an electrical control panel manufacturer regularly engaged in this type of work.

.6 Shop Drawings for the electrical enclosures are to be submitted in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

2.1 RTU CABINET

.1 Refer to 2.0 Controls Cabinet (CP-1) for RTU Cabinet specifications.

2.2 VFD CABINET

.1 Not used.

2.3 CONTROL CABINET COMPONENTS

.1 Selector Switches:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.2 Indicators/Pilot Lights:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.3 Push buttons:

.1 Refer to Technical Specification 26 29 03 Control Devices

.4 HMI:

.1 Refer to Technical Specification 26 27 17 Programmable Logic Control.

.5 Ethernet Bulkhead Receptacle:

.1 Refer to Technical Specification 26 27 26 Wiring Devices.

.6 Network switch:

.1 Refer to Technical Specification 26 29 05 Data Communications Infrastructure.

.7 PLC/RTU Equipment:

.1 Refer to Technical Specification 26 27 17 Programmable Logic Controller.

.8 Interposing Relays:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.9 Intrinsically Safe Relays:

.1 Not used.

.10 Intrinsically Safe Barriers:

.1 Not used.

.11 24VDC Power Supply and Diode Module

.1 Refer to Technical Specification 26 29 03 Control Devices.

.12 UPS

.1 Refer to Technical Specification 26 33 53 Static Uninterruptible Power Supply.

.13 Circuit Breakers

.1 Refer to Technical Specification 26 27 16 02 Molded Case Circuit Breakers.

.14 Terminals and Interconnect Wiring:

.1 In accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

.2 DIN rail mounted terminals complete with dividers and end stops as required. Provide 10 spare terminals on each section and additional spare terminals as noted on the Contract Drawings.

.3 Utilize plastic finger wiring ducts for organization of all interior and field wiring. Ducts are to be filled to no more than 50% of capacity.

.4 Use ferrules at termination points on stranded wires.

.5 A space of 200 mm must be kept clear for field wiring. All wiring labels must be clearly visible at completion.

2.4 ELECTRICAL KIOSK

.1 Not used.

Part 3 Execution

3.0 INSTALLATION

.1 Install cabinets as indicated in the Contract Drawings.

.2 Apply touch up paint as required.

.3 Make field power and control connections as indicated.

.4 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.

.5 Supply all necessary equipment and wiring to provide the points connected to the equipment as indicated on the Contract Drawings.

.6 Assemble the control cabinets to include the components identified within the Contract Documents and indicated on the Contract Drawings.

.7 Supply, install, and connect external sensors and components as shown on the Contract Drawings.

.8 Contractor to install radio and ancillary equipment including, but not limited to, antenna and coax cabling. Contractor to coordinate radio configuration and antenna aiming with Owner where indicated on the Contract Drawings.

3.1 CONTROLS

.1 Refer to process narrative for programming requirements.

3.2 MAINTENANCE MATERIALS

.1 Provide:

.1 Ten (10) spare fuses of each type used in the panel, as required.

.2 One (1) control relay of each type used in the control panel.

.3 Any other components which the Contractor recommends to be kept as spares.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate system to prove satisfactory performance of complete system during 24 hour period.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of Programmable Logic Controllers (PLC) and operator stations.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 PLCs and HMIs to be sent to PBX Engineering Squamish office for Factory Acceptance Testing prior to site installation.

Part 2 Products

2.0 FUNCTION

.1 PLC systems to be control panel mounted and be capable of integration with existing SCADA control system.

.2 Provide PLC arrangement as shown on the Contract Drawings for each of the three stations, P291, P279, and W212. The PLC CPU located in P291 shall provide singular control for the three stations. PLC remote I/O racks installed in each station will communicate with this central CPU. Each PLC remote I/O rack should house all required discrete and analog I/O cards and communication cards as listed under Section 2.2 PLC Equipment.

.3 EtherNet/IP network shall be used for communication between the PLCs, condition monitoring devices, and VFDs.

2.1 PLC AND HMI

.1 Install PLC hardware and HMI in accordance with the manufacturer's latest installation publication.

.1 HMI applies to P291 and W212 only. Refer to Contract Drawings for PLC equipment layouts and HMI.

.2 Utilize best practices input/output (I/O) addressing as defined by the programming manual for the chosen controller system. Do not use complimentary I/O addressing.

.3 All equipment I/O points are to be isolated points powered from the equipment being controlled.

2.2 PLC EQUIPMENT

.1 Provide equipment in conjunction with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 P291:

.1 Controller Platform: CompactLogix 5370

.1 CPU: 1769-L33ER

.2 I/O Platform:

.1 1769-IQ16 (16 Point 24VDC Input Module)

.2 1769-OW16 (16 Point Relay Output Module)

.3 1769-IF8 (8 Channel Analog Voltage/Current input Module)

.4 1769-OF8CI (4 Channel Isolated Analog Current Output Module)

.3 P279:

.1 Communications Module:

.2 1769-AENTR (Ethernet Communications Module)

.3 MV169E-MBS (Serial Interface Module)

.1 Remote I/O Platform:

.4 1769-IQ16 (16 Point 24VDC Input Module)

.5 1769-OW8I (8 Point Isolated Relay Output Module)

.6 1769-IF8 (8 Channel Analog Voltage/Current input Module)

.7 1769-OF8C (4 Channel Analog Current Output Module)

.4 W212:

.1 Communications Module:

.1 1769-AENTR (Ethernet Communications Module)

.1 Remote I/O Platform:

.2 1769-IA16 (16 Point 120VAC Input Module)

.3 1769-OW8I (8 Point Isolated Relay Output Module)

.4 1769-OW8 (8 Point Relay Output Module)

.5 1769-IF8 (8 Channel Analog Voltage/Current input Module)

.6 1769-OF8CI (4 Channel Isolated Analog Current Output Module)

.5 Provide a 1769-PA4 power supply for each PLC rack.

.6 Provide HMIs for equipment operation and alarming, completely configured, and programmed and complete with programming software.

.1 Applies to P291 and W212 only.

.2 Configure and wire HMI in accordance with the manufacturer's installation and programming manual.

.3 Standard of acceptance: Allen-Bradley PanelView Plus 7 15" HMI.

2.3 PLC CONTROL PANEL (P291)

.1 Refer to Technical Specification 26 27 16 - Electrical Cabinets and Enclosures for control panel details.

2.4 WIRING

.1 All wire and cable to meet requirements of Technical Specification 26 05 21 Wires and Cables (0-1000V).

.2 Wire all I/O card terminations to terminal blocks, whether used or spare.

2.5 GROUNDING AND BONDING

.1 Ground and Bond per Technical Specification 26 05 28 Grounding – Secondary.

2.6 PROGRAMMING

.1 PLC and remote I/O programming and associated testing will be performed by others.

Part 3 Execution

3.0 INSTALLATION

.1 Install Control Panel in P291 as per Technical Specification 26 05 00 Common Work Results – Electrical and as shown in the Contract Drawings.

.2 Mount PLC components in control panels in each of the three stations, P291, P279, and W212 as per the Technical Specifications 26 27 16 Electrical Cabinets and Enclosures.

.3 Mount the PLCs and HMIs at an ergonomically correct operating height.

3.1 FIELD QUALITY CONTROL

.1 Provide testing and commissioning in accordance with Technical Specification 26 05 10 Testing and Commissioning.

.2 Test all PLC I/O panel wiring connections, testing of all HMI screens and pushbutton functions, testing of all interlocks with equipment supplied by others, confirming the operation integrity of all network communications.

3.2 COMMISSIONING

.1 Provide assistance during commissioning of the control system by Owners PLC/ HMI programming representative for a minimum of five days.

.2 Provide VFD technician for support during commissioning for a minimum of two days.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

- .1 CSA C22.2 No. 42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CSA C22.2 No. 42.1-13, Cover Plates for Flush Mounted Wiring Devices (Bi national standard, with UL 514D).
- .3 CSA C22.2 No. 55-15, Special Use Switches.
- .4 CSA C22.2 No. 111-10, General Use Snap Switches (Bi national standard, with UL 20).
- .5 CSA-C22.2 No. 177-13, Clock-operated Switches
- .6 CSA-C22.2 No. 184-15, Solid-State Lighting Controls

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SWITCHES

.1 15A, 120 V, single pole, specification grade switches to: CSA-C22.2 No. 55 and CSA-C22.2 No. 111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.3 Toggle operated fully rated for tungsten filament, fluorescent, and LED lamps, and up to 80% of rated capacity of motor loads.

.4 Provide switches with occupancy sensors for control of interior lighting.

.5 Switches will be of one manufacturer throughout the Project.

2.1 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R/20R as indicated, 125 V, 15/20 A as indicated, U ground, to: CSA-C22.2 No.42 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.2 Other receptacles with ampacity and voltage as indicated in Contract Drawings.

.3 Receptacles will be of one manufacturer throughout the Project.

.4 Ground fault interrupting capabilities as indicated in Contract Drawings.

.5 Ethernet Bulkhead Receptacle:

.1 Application: Feed-thru coupler

.2 Mounting: Jam nut panel mount

.3 Connector: Female RJ45

.4 Rating: IP67-weatherproof with attached cap.

2.2 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No. 42.

.2 Cover plates will be of one manufacturer throughout the Project.

.3 Stainless steel.

.4 Weatherproof RPVC cover plates for surface-mounted FS or FD Type boxes.

.5 Weatherproof clear, lockable, while-in-use cover plates for all GFI locations, as indicated in Contract Drawings.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Install identification labels indicating circuit, voltage, and phase.

Part 3 Execution

3.0 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Technical Specification 26 05 00 Common Work Results – Electrical or as indicated on the Contract Drawings.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Technical Specification 26 05 00 Common Work Results – Electrical or as indicated on the Contract Drawings.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated on Contract Drawings.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.1 PROTECTION

.1 Protect installed products and components from damage during Construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials for molded-case circuit breakers.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results for Electrical.

.2 Technical Specification 26 27 16 – Electrical Cabinets and Enclosures

.3 Technical Specification 26 24 16 01 – Panelboard Breaker Type

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489 and NMX-J-266-ANCE).

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Submit trip unit datasheets and time-current characteristic curves for breakers to the Contract Administrator.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 BREAKERS GENERAL

.1 Molded case circuit breakers based on CSA C22.2 No. 5-16.

.2 Bolt-on molded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.5 Circuit breakers in Panelboards to have minimum interrupting capacity ratings as indicated on the Contract Drawings.

2.1 THERMAL MAGNETIC BREAKERS

.1 Molded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.2 SOLID STATE ELECTRONIC TRIP BREAKERS

.1 Solid state electronic trip breakers as indicated on Contract Drawings.

.2 Common trip breakers: with single handle for multi pole applications.

.3 Molded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long-time/short time/instantaneous tripping for short circuit protection.

.4 Programmable electronic solid state trip unit with separately adjustable long time, short time, and instantaneous.

.5 Circuit Breakers to have auxiliary contact for PLC notification of breaker status (contact changes state when breaker is open), where indicated on Contract Drawings.

.6 Circuit breakers with interchangeable trips as indicated on Contract Drawings.

.7 Circuit breakers to have minimum interrupting capacity ratings as indicated on Contract Drawings.

.8 Refer to single line diagrams within Contract Drawings. System has been designed to achieve arc flash incident energy levels of less than 1.2 calories/cm2 for all points downstream of main utility circuit breaker. Provide circuit breakers as required to achieve same.

.9 Standard of Acceptance: Same as MCC manufacturer.

2.3 ENCLOSURE

.1 Provide enclosures for breakers as specified in Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets.

Part 3 Execution

3.0 INSTALLATION

.1 Manufacturer’s instructions to be followed for circuit breaker installation.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Contactor materials, installation.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results for Electrical.

1.3 REGULATORY REQUIREMENTS

.1 CSA International

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled.

.3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.4 Mount in MCC unless otherwise indicated.

.5 Include following options in cover:

.1 [Red] [Green] indicating lamp.

.2 [Stop-Start] pushbutton.

.3 [Hand-Off-Auto] selector switch.

.4 [On-Off] selector switch.

.6 Control transformer: in accordance with Technical Specification [26 29 03 - Control Devices], factory wired and installed in contactor enclosure.

2.1 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical.

.2 Size 4 nameplate indicating name of load controlled, source panel and circuit, voltage, and phase.

Part 3 Execution

3.0 INSTALLATION

.1 Install contactors and connect power wires and auxiliary control devices.

.2 Identify contactors with nameplates or labels indicating panel and circuit number.

.3 Test contactors in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 – Testing and Commissioning.

3.1 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by contractor installation.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for electrical control devices.

.2 Some equipment and devices listed under the Products section may not be utilized for this project. The Contractor shall refer to the Contract Drawings to identify which equipment is required.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results - Electrical.

.2 Technical Specification 26 27 16 Electrical Cabinets and Enclosures.

1.3 REGULATORY REQUIREMENTS

.1 CSA International

.1 CSA C22.2 No. 14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No. 14.

.2 Unless otherwise noted, use flat-pin encapsulated type plug-in relays.

.3 120 VAC relays: General purpose, 2PDT, plug-in, complete with test button, operation indicator, and surge suppressor.

.4 24 VDC relays: General purpose type, 2PDT, plug-in, complete with test button, operation indicator (red), and surge suppression RC Circuit. RC circuit may be external to relay using manufacturer's approved components, soldered and insulated using heat-shrink sleeves.

.5 Relay contacts: Form C rated 110 VAC, 10A resistive, and 7.5 A inductive.

.6 Provide retainer to hold/secure relay in seated position.

2.1 TIMING RELAYS

.1 Unless otherwise noted, use plug-in timer relays.

.2 Time delay relays for behind panel-mounting: 2PDT, plug-in, and programmable for 16 time ranges and 6 operation modes.

.3 Time delay relays for flush panel mounting and accessible timing range modifications: SPDT, screw terminals, programmable for five timing ranges and nine operation modes, complete with digital display, module for time settings, and flexible protective cover.

.4 Output contact: Form C rated at 250 VAC, 5 amp with p.f. = 1.

.5 Provide relay plug-in sockets for DIN mounting, complete with stacked screw clamp terminals.

.6 Provide retainer to hold/secure relay in seated position.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 DOOR SWITCHES

.1 Provide door switches mounted to the doorways such that actuation occurs when the outer door is opened, the switch is triggered.

.2 Door switch shall have a lever type actuation with 1 normally open and 1 normally closed set of contacts.

.3 Door switch shall be suitably rated for hazardous application locations where indicated on the Contract Drawings.

2.4 LIMIT SWITCHES

.1 Minimum standard is heavy duty, oiltight, or as specified for field-located devices.

.2 Adjustable wand-type operating levers.

2.5 PUSHBUTTONS

.1 Panel mountable, 120VAC/24VAC/DC rated, as required, momentary contacts, normally open, 30mm.

.2 Bezel Material: Chromium Plated Metal.

.3 Oil-tight / NEMA 4X for outdoor installations.

.4 Colour: Black unless otherwise indicated on Contract Drawings.

2.6 SELECTOR SWITCHES

.1 Panel mountable, two, three or four position, as indicated on the Contract Drawings, 30mm.

.2 Contact arrangement as indicated and to suit control requirements.

.3 120VAC/24VAC/DC rated, as required.

.4 Bezel Material: Chromium Plated Metal

.5 Oil-tight / NEMA 4X for outdoor installations.

.6 Colour: Black unless indicated otherwise on Contract Drawings.

2.7 INDICATING LIGHTS

.1 Panel mountable, round, LED-based, push-to-test, 30mm, 120VAC/24VAC/DC rated, as required.

.2 Bezel Material: Chromium Plated Metal

.3 Oil-tight / NEMA 4X for outdoor installations.

.4 Colour as indicated on Contract Drawings.

2.8 CONTROL CIRCUIT TRANSFORMERS

.1 Refer to Technical Specification 26 12 16 01 – Dry Type Transformers up to 600V Primary.

2.9 24VDC POWER SUPPLY

.1 Basis of design: Phoenix Contact QUINT4-PS/1AC/24DC/20.

2.10 DIODE MODULE

.1 Basis of design: Phoenix Contact QUINT-DIODE/12-24DC/2X20/1X40.

2.11 CONTROL FUSE HOLDERS AND FUSES

.1 Applicable to fuses protecting control circuits, primary and secondary windings of instrument transformers, voltage sensing circuits, and other similar circuits.

.2 Type and size as shown or as selected by panel builder for optimum protection of equipment being served.

.3 Door-mounted fuse holders for small-dimension fuses 6.4 x 31.8 mm (¼" x 1¼ "). Where possible, use different models for different voltages:

.1 120 VAC circuits, Type HKL with clear octagon knob.

.2 12 V dc circuits, Type HKT with amber octagon knob.

.3 24 V dc circuits, Type HKX with amber flat sided knob.

.4 Fuse holders mounted on back pan to be finger safe dead-front type for use with HRC fuses.

2.12 INTRINSICALLY SAFE RELAYS

.1 Not used.

2.13 INTRINSICALLY SAFE BARRIERS

.1 Not used.

Part 3 Execution

3.0 INSTALLATION

.1 Install control devices as indicated in Contract Drawings. Make readily accessible for servicing maintenance and adjustments.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

END SECTION

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P2	September 22, 2023	Issued for Tender	WW	BW
P1	August 30, 2023	Issued for Final Review	WW	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for Transmitting and Indicating devices.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results for Electrical.

1.3 REGULATORY REQUIREMENTS

.1 CSA International

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 GENERAL

.1 Provide each device as a pre-assembled, packaged unit. Upon delivery to the Work Site, each system shall be ready for installation with only final piping and electrical connections required by the Contractor.

.2 Provide power supply to the transmitters and as indicated on the Contract Drawings. Derive any required power for the primary elements from the transmitter.

.3 Install the transmitters to measure the specified process at the ranges and conditions indicated on the Contract Drawings.

.4 Factory-calibrate transmitter to the calibration ranges specified on the Contract Drawings. Calibrate transmitters using NIST-approved bench calibration procedures. Store calibration data digitally in the transmitter. Program transmitter with the instrument tag designation indicated on the Contract Drawings. Submit factory calibration data as described elsewhere in this Technical Specification.

.5 Unless otherwise specified, provide transmitters with integral isolated 4-20 mA output “two wire type” transmitters with operating power derived from the signal loop. Transmitters are to support an external load of up to 600 ohms or greater with a loop power supply of 24 VDC.

.6 Provide transmitters with adequate power output to drive devices associated with that signal loop. Provide signal boosters as required to achieve adequate signal strength.

.7 Transmitter’s 4-20 mA output is to be galvanically isolated from the process and the transmitter case.

.8 Provide microprocessor-based transmitters. For the pressure transmitter sensing cells an isolating diaphragm in combination with a sensing diaphragm using silicone oil as a pressure transmission medium.

.9 Transmitters shall not be damaged by reverse polarity.

.10 Transmitters are to have local indication scaled in Engineering Units and are to include a lamacoid label indicating the Engineering Units. Mount the transmitter such that this indication is correctly oriented and visible from the normal operating floor position.

.11 Transmitters are to have a 3½ digit LCD display, calibrated in engineering units.

.12 Transmitter and/or primary element enclosures (or housings) are to be, as a minimum, rated NEMA 4; where located outdoors or in areas specified as corrosive, enclosures to meet NEMA 4X requirements.

.13 Transmitter flanges, adaptors, and associated bolts, nuts, etc. are to be fabricated from 316 stainless steel.

.14 Two spare fuses of each type required.

2.1 MOUNTING HARDWARE

.1 Provide all mounting brackets, cables, connectors, and hardware necessary to install primary elements.

.2 Provide brackets and mounting hardware to allow standard 50mm pipe-stand or wall mounting, unless otherwise noted.

.3 Fabricate brackets from aluminum or stainless steel and all sundry hardware from stainless steel.

.4 Primary elements and transmitters are to be complete with necessary liquid filling, identification, configuration, etc. as necessary to make the unit ready for use.

2.2 INTERCONNECTING CABLE

.1 Provide an interconnecting cable from the element to the transmitter for systems where the primary element and transmitter are physically separated.

.2 The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter.

.3 Length of cable shall be as indicated in the Instrument Specification Sheet, or if not specifically indicated, shall provide a continuous unbroken length sufficient to route via approved supports from the element to the transmitter plus additional length to permit the element to be easily removed and reinstalled.

2.3 PROGRAMMING DEVICE

.1 For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, provide two such programming devices for each class or type of instrument. Include appropriate operation manuals and the programming device in the training requirements.

.2 For systems that allow the programming device functions to be implemented in software, running on a laptop computer, provide two full licensed copies of the software instead of the programming device.

2.4 CONTROL COMPONENTS

.1 Refer to the Contract Drawings for the required control components in pump stations P291, P279, and W212.

.2 Flow Meters:

.1 Flow meter transmitters wall-mounted where indicated. Otherwise, flow meter transmitter to be installed directly on flow meter assembly.

.2 I/O:

.1 Flow Rate: 4-20mA signal for instantaneous flow

.2 Totalizer: Pulsing output

.3 Power: 120VAC for transmitter supply.

.4 Connecting Cables (for remote mounted transmitters):

.1 Factory manufactured electrode and coil current cables.

.2 Length: to suit installation.

.3 Coil excess cable in a neat bundle.

.5 Approvals: Zone 1, Group IIC, or equivalent Class/Division rating.

.6 Refer to Mechanical Specifications for additional information and details regarding the flow meter assembly.

.7 Standard of acceptance: E&H Proline Promag W400.

.3 Float Switches:

.1 Provide float switches with contacts that will activate in the presence of liquid.

.2 Specific Gravity: 0.95 – 1.10

.3 Materials:

.1 Body: Polypropylene (Grey)

.2 Length: 162mm

.3 Strain Relief: EPDM Rubber

.4 Weight: Zinc

.4 Cable:

.1 Factory manufactured cable.

.2 Length: to suit installation. 20m minimum.

.3 Coil excess cable on hanger cable support.

.5 Approvals: Zone 1, Group IIC, or equivalent Class/Division rating.

.6 Standard of acceptance: Flygt ENM-10.

.4 Booster Pump Temperature Switches:

.1 Temperature switches to be included as part of the pump assembly.

.2 Refer to Mechanical Specifications for additional information.

.5 Pressure Transmitters:

.1 Provide pressure transmitter to be installed as indicated in the Contract Drawings.

.2 I/O:

.1 Pressure: 4-20mA signal for instantaneous pressure.

.3 Power: 24VDC loop powered.

.4 Approvals: Zone 1, Group IIC, or equivalent Class/Division rating.

.5 Refer to Mechanical Specifications for additional information.

.6 Standard of acceptance: E&H Cerabar PMC51B.

.6 Radar Level Sensor Equipment:

.1 Tank mounted assembly.

.2 Power: 4-20mA loop powered.

.3 Approvals: Zone 1, Group IIC, or equivalent Class/Division rating.

.4 Standard of acceptance: VEGAPULS 21 radar sensor and VEGAMIT 682 Panel Display and Controller.

.7 Motorized Valve Actuators:

.1 MV-001A, MV-005A, MV-007D, MV-038B:

.1 Power: 120VAC.

.2 Standard of acceptance: Rotork IQT Series.

.2 MV-008G:

.1 Power: 120VAC.

.2 Standard of acceptance: Bray Series 70.

.3 MV-030D, MV-031D:

.1 Power: 24VDC.

.2 Standard of acceptance: Chemline ER Series.

.8 Check Valve Limit Switches

.1 Standard of acceptance: Honeywell HDLS Series.

.9 Valve Limit Switches:

.1 Standard of acceptance: CLA-VAL X105LCW for valve closed position status.

.10 Solenoid Valves:

.1 Standard of acceptance: ASCO.

.11 Chlorine/pH Analyzer:

.1 Installed in P279 pump station as indicated in the Contract Drawings.

.2 Measurement: Free Chlorine.

.3 Power: 120VAC.

.4 Sensor style: Sensor with constant head flowcell and 25ft cable.

.5 pH sensor input: standard pH sensor with 25ft cable and adaptor for overflow cell.

.6 Digital output: None

.7 System assembly: Panel with flow controls, without flow switch

.8 Standard of acceptance: ATI Model Q46H/62-1-1-3-1-1-2.

.12 Power Meter:

.1 Standard of acceptance: GE Multilin EPM 7000.

.13 Room Temperature Sensors:

.1 Standard of acceptance: WIKA TR60 Indoor Thermometer complete with T15.H 4-20mA Digital Temperature Transmitter, or approved equivalents.

.14 Caustic Tank Temperature Sensors:

.1 Embedded RTD sensors to be part of vendor-supplied caustic holding tanks.

.2 RTD transmitter installed in local junction box to provide conversion to 4-20mA signal.

.1 Standard of acceptance: WIKA T15.H, or approved equivalent.

Part 3 Execution

3.0 INSTALLATION

.1 Supply a multi-pole receptacle with all instruments.

.2 Mount transmitters so that interference to the function is not caused by surrounding structures.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical and Technical Specification 26 05 10 Testing and Commissioning.

END SECTION

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of network equipment and topology required.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results for Electrical.

1.3 REGULATORY REQUIREMENTS

.1 TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard.

.2 TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces.

.3 TIA/EIA-606A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

.4 TIA/EIA-607A Commercial Building Grounding and Bonding Requirements for Telecommunications.

.5 TIA/EIA-TSB140 Additional guidelines for field testing of Optical Fibre Cabling Systems.

.6 Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – Current edition.

.7 National Fire Protection Agency (NFPA) - 70, Canadian Electrical Code (CEC) – Current Edition.

.8 ISO / IEC 11801 Information Technology - Generic cabling for customer premises.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 GENERAL

.1 All equipment shall be complete with all necessary appurtenances to perform the functions indicated on the Contract Drawings with respect to input and outputs.

.2 The equipment shall be complete with all accessory items, whether specifically mentioned or not, to provide completeness of installation and operation as intended.

2.1 ETHERNET PATCH PANELS

.1 Not used.

2.2 FIBRE OPTIC PATCH PANELS

.1 Fibre Optic Patch Panel shall include the following features:

- .1 Mounting: Closet connector housing, panel mountable
- .2 Capacity: Single-panel housing, 6 fibre count
- .3 Connectors: ST
- .4 Standard of Acceptance: Corning CCH and Corning CCH-CP

2.3 NETWORK SWITCHES

.1 Application: managed industrial ethernet switch

- .1 Ports: 10 or 20 port as required, 2 fibre ports
- .2 Power supply: 24VDC
- .3 Mounting: DIN or panel mounted.
- .4 Configurable alarm contact
- .5 Mean time between failure: minimum 1,000,000 hours
- .6 Standard of Acceptance: Allen Bradley Stratix 5700 Series.

2.4 MULTIMODE AND SINGLEMODE CONNECTORS

.1 All Connectors shall be TIA compliant duplex connectors.

.2 Strain relief: connectors only, the connector will provide a strain relief mechanism for installation onto a single fibre cable that contains strength elements. The fibre within the body of the connector will be isolated mechanically from cable tension, bending and twisting.

.3 Index matching material: The connector will require index-matching material within the splice components of the connector.

.4 Intermateability: The connector will be designed in compliance with the appropriate TIA/EIA FOCIS document.

.5 Installation on field fibre: The connector will contain a mechanical splice and require one tool kit to assemble all connector types.

.6 Installation polishing: The connector will not require polishing of the end face in the field. Connectors will have a factory-polished fibre stub in the connector ferrule.

.7 Installation type: The connector installation will not require the use of epoxies.

.8 Fibre protection: The connector's factory stub fibre will be secured with epoxy to protect the bare fibre from the ingress of air or waterborne contaminants and will secure the fibre in the ferrule micro-hole.

.9 Each connector will be equipped with a protective dust cap that does not contaminate the connector end face.

2.5 MULTIMODE PATCHCORDS

.1 Not used.

2.6 SINGLE MODE PATCHCORDS

.1 Supply Patch cords for single mode fibre (with lengths to suit) as required, plus 25% spare capacity.

2.7 COPPER (ETHERNET) PATCHCORDS

.1 Supply Patch cords from Cisco Switches to Media Converters (with lengths to suit) as required, plus 25% spare capacity.

2.8 ANTENNA

.1 Type: 7 Element Yagi

.2 Frequency: 746-960MHz

.3 Gain: 10dBd

.4 Polarization: Vertical or Horizontal

.5 Connector: N-Type (Male)

.6 Mount: pole mount, stainless steel

.7 Installation:

.1 Antenna is to be mounted on new luminaire/antenna pole.

.2 Coaxial cable shall be run inside pole and shall emerge from pole via weatherhead.

.3 Provide all required grounding for antenna as per Canadian Electrical Code and all applicable standards.

.4 Ground kit installation shall occur at electrical kiosk entrance before surge suppression.

.5 Aim antenna in coordination with Owner and Related Projects.

.8 Standard of Acceptance: Comprod 980-70.

Part 3 Execution

3.0 INSTALLATION

.1 Performance Verification

.1 Copper

.1 Category 6 data cabling systems shall be performance verified using an automated test set. This test set shall be a Level III qualified tester approved by the cabling manufacturer. The test shall be permanent link which tests for the following performance parameters:

- Wire Map
- Length
- Insertion Loss
- Pair-to-Pair Near End Crosstalk (NEXT)
- Power Sum Near End Crosstalk (PSNEXT)
- Equal Level Far End Crosstalk (ELFEXT)
- Power Sum Equal Level Far End Crosstalk (PSELFEXT)
- Return Loss (RL)
- Propagation Delay
- Delay Skew

.2 Category 6 data cable shall be performance verified using an automated test set. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/TIA/EIA-568-B.2.1 Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall

include all tests performed, the expected test result and the actual test result achieved.

.2 Fibre

.1 All cabling, which this contractor terminates shall be tested to applicable TIA/EIA standards.

.2 The insertion loss for each mated fibre connector pair shall be <0.75dB. Mated connector pair loss testing shall be based on one unidirectional OTDR inspection in accordance with the OTDR operating manual for systems. (TSB 140 level 2) In addition to connector insertion loss for each mated pair, this contractor shall perform end to end insertion loss testing for each multimode fibre at 850nm and 1300 nm from one direction for each terminated fibre span in accordance with TIA/EIA-526-14A (OFSTP 14) and single-mode fibres at 1310 nm and 1550 nm from one direction for each terminated fibre span in accordance with TIA/EIA 526-7 (OFSTP 7). For spans greater than 90 meters, each tested span must test to a value less than or equal to the value determined by calculating a link loss budget. For horizontal spans less than or equal to 90 meters, each tested span must be <2.0 dB.

.3 The optical fiber cabling link segment shall be tested in at least one direction at both operating wavelengths to account for attenuation deltas associated with wavelength. Single-mode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper. Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to

determine acceptance values based upon this Standard's component requirement at each of the applicable wavelengths.

.3 Distance and Footprint

.1 OTDR testing will be for length verification only and be conducted in accordance with ANSI/TIA/EIA-526-7.

.2 Documentation to be recorded for OTDR test results shall include:

- Date of the test.
- Description of equipment used, manufacturer model number and serial number.
- Date of latest equipment calibration.
- Test personnel.
- Trace of the fiber or cabling link.
- Fiber identifier or circuit identifier with fiber length and fiber attenuation of events.
- Test wavelength(s).

3.1 FIBRE PATCHCORDS

.1 Use the following guidelines when installing fibre patchcords in cable trays or ladder racks.

.1 Route fibre optic cable on the outside of the cable tray or ladder rack if possible. Use flexible conduit throughout the installation to prevent crushing from later cable installations. Gravenhurst Orange Plastic Riser Conduit FT4.

.2 Use Velcro style ties to secure the cable to the cable tray or rack every 60-90cm (24-36 inches).

.3 Caution: Do not tighten the ties to the point they deform the shape of the cable conduit.

.4 Maintain the fibre optic cable’s minimum bend radius around corner through the use of flexible conduit or other supports. (20 x OD in install and 10 x OD static).

.5 At raceway transitions, maintain the minimum bend radius and provide support and protection for the cable through the use of flexible conduit.

.6 When routing cable into equipment from the ceiling or ladder rack, use flexible conduit to maintain the cable’s minimum bend radius.

3.2 ARMOURED FIBRE CABLE VERTICAL RUNS

.1 Use the following guidelines when installing cable in vertical runs:

.1 Work from the top down, when possible.

.2 Install a split wire mesh support grip at the top of each run prior to entering termination hardware or horizontal distribution.

.3 Each fibre optic cable in the vertical run needs to be supported by its own support grip at the top of the run.

.4 Never use fibre optic cables as support for other cables.

.5 Cables that are individually supported may be taped or cable-tied together every 3 m (10ft) for cable management – not support.

.6 Install additional support grips wherever additional security is desired.

.7 Securing the cable to the riser shaft with a split-grip every 6 m (20ft) is recommended in order to keep the cable in its desired location.

.8 Secure the cable in riser wiring closets with cable ties or straps as needed to prevent accidental damage to cable.

.9 Ensure that governing fire codes are maintained through the use of non-combustible tubing or fire stops at each floor.

3.3 ARMOURED FIBRE CABLE IN CABLE TRAYS AND LADDER RACKS

.1 Use the following guidelines when installing cable in cable trays or ladder racks.

.1 Install the cable so as to minimize potential damage when additional cables are installed or retrieved.

.2 Route fiber optic cable on the outside of the ladder rack if possible. Use flexible conduit throughout the installation to prevent crushing from later cable installations.

.3 Use Velcro style ties to secure the cable to the cable tray or rack every 60-90 cm (24-36 inches).

.4 Caution: Do NOT tighten the ties to the point they deform the shape of the cable.

.5 Maintain the fibre optic cable's minimum bend radius around corner through the use of flexible conduit or other supports. (20 x OD in install and 10 x OD static).

.6 At raceway transitions, maintain the minimum bend radius and provide support and protection for the cable through the use of flexible conduit.

.7 When routing cable into equipment from the ceiling or ladder rack, use flexible conduit to maintain the cable's minimum bend radius.

3.4 PACKING AND SHIPPING OF FIBRE

.1 When storing fibre cable, both ends of the cable shall be sealed to prevent the ingress of moisture.

.2 Never store, ship or lay a reel of fibre cable on its side.

3.5 TERMINATION OF FIBRE STRANDS

.1 All strands of each fibre cable installed must be terminated both ends in the appropriate patch panel whether the fibre is used or not.

.2 All terminations and patch cords must be tested using TSB 140 level 2 procedures by a qualified technician. Results of testing must be submitted to the Contract Administrator.

3.6 NETWORK CONNECTIONS

.1 Configure all fibre patch panels, switches, media converters, TVSS's, wall jacks, fibre patch cords, copper patch cords and other devices as required to provide a complete and functional communications system(s) as specified in this Section.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical and Technical Specification 26 05 10 Testing and Commissioning.

END SECTION

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of motors.

1.2 RELATED TECHNICAL SPECIFICATION

.1 Technical Specification 26 05 00 - Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 International Electrotechnical Commission (IEC)

.1 IEC 947-4-1, Part 4: Electromechanical contactors and motor-starters.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 MATERIALS

.1 Starters: to IEC 947-4 with AC4 utilization category.

.2 Extra Materials:

.1 Provide listed spare parts for each different size and type of starter.

.1 3 contacts, stationary.

.2 3 contacts, movable.

.3 1 contact, auxiliary.

.4 1 control transformer[s].

.5 1 operating coil.

.6 3 fuses. (if applicable)

2.1 MANUAL MOTOR STARTERS

.1 Not required.

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic or combination magnetic starters as indicated on Contract Drawings.

.2 Size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.3 Combination type starters to include circuit breaker with operating lever on outside of enclosure to disconnect circuit breaker, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

2.3 FULL VOLTAGE REVERSING MAGNETIC STARTERS

.1 Not required.

2.4 MULTI-SPEED STARTERS

.1 Not required.

2.5 MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER

.1 Not required.

2.6 VARIABLE FREQUENCY DRIVES (VFDS)

.1 Refer to Technical Specification 26 29 23 11 - Variable Frequency Drive.

2.7 ACCESSORIES

.1 Pushbuttons: heavy duty, oil tight.

.1 Overload reset

.2 Selector switches: heavy duty, oil tight.

.1 Hand-off-Auto

.3 Indicating lights: LED, heavy duty.

.1 Running – Green

.2 Stopped - Red

.4 Provide Size 1 nameplate for all accessories mounted on front of starter.

.5 Auxiliary control devices as indicated.

2.8 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.9 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated.

.3 Where starters are installed outside of an MCC, starter designation label shall include equipment ID and description, phase, voltage, upstream distribution source panel and circuit.

.4 Where starters are installed in an MCC, starter designation label shall include equipment ID and description.

.5 Obtain approval from Consultant for wording of identification labels prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results - Electrical.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of Variable Frequency Drives (VFDs).

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets

.3 Technical Specification 26 05 10 Testing and Commissioning

1.3 REGULATORY REQUIREMENTS

.1 The Variable Frequency Drives (VFD) and all components shall be designed, manufactured and tested in accordance with the latest applicable standards.

- .1 IEEE 519-1992: Guide for harmonic content and control
- .2 UL508C: Power Conversion Equipment
- .3 cUL
- .4 NEMA ICS 7.0: Industrial Controls & Systems for AFD
- .5 IEC 61800-2 and -3
- .6 EN 50082-1 and -2
- .7 Fulfill all EMC immunity requirements

.2 In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 HARMONIC MITIGATION

.1 Line Filter Equipment:

.1 Provide an integrated 5% DC link choke or open frame line reactor. External choke is not acceptable.

.2 DC choke:

.1 The choke shall be a two-coil design. DC choke shall include input surge protection.

.3 Line reactor:

.1 Provide open frame line reactor as indicated on the Contract Drawings on the line side of the VFD.

.2 Mount within VFD Cabinet.

.3 Standard of Acceptance: Transcoil KDR Series or approved alternate.

.2 Load Filter Equipment:

.1 Provide dv/dt filter located at the VFD and shall reduce the dv/dt clamp any voltage overshoots of the VFD output. It will return the energy in the voltage overshoots to the VFD DC bus. A power dissipative resistance device is not acceptable.

.2 Standard of Acceptance: Eaton MotorRx type or approved alternate.

2.1 VARIABLE FREQUENCY DRIVES (VFD)

.1 Pump Motors

.1 The VFDs shall be selected in accordance with the pump motor ratings, Refer to Contract Drawings for motor sizing.

.2 Constant Torque

.3 Overload rating:

.1 150% for one minute of motor FLA

.2 110% continuous of motor FLA.

.4 Provide Terminal blocks for field wiring.

.5 Include inputs for VFD start/stop.

.6 Include relay outputs for VFD running and fault status.

.7 Include analog inputs/outputs for VFD speed setpoint and feedback.

.8 Provide adequate ventilation for stated site conditions.

.9 Mount within enclosure.

.10 Provide remote mounted control panel installed on front door of VFD cabinet.

.1 Include panel platform for docking of control panel.

.11 Standard of Acceptance: ABB ACQ580.

2.2 VFD COMMUNICATIONS

.1 The VFD shall provide at a minimum 1 EtherNet/IP communications port.

2.3 CIRCUIT BREAKER

.1 Refer to Technical Specification 26 28 16 02 - Molded Case Circuit Breakers.

2.4 CONTROL CIRCUIT TRANSFORMERS

.1 Refer to Technical Specification 26 12 16 01 - Dry Type Transformers up to 600V Primary.

2.5 THERMOSTAT (LINE VOLTAGE)

.1 Refer to Technical Specification 26 54 00 – Heaters and Ventilation.

Part 3 Execution

3.0 INSTALLATION

.1 Install control devices and interconnect as indicated on the Contract Drawings and per manufacturers recommendations.

3.1 FACTORY TESTING

.1 Tests shall be performed to verify the proper operation of control devices, input and output signals, local control functions, and indication and alarm points.

.2 The Consultant reserves the right to witness the factory tests. Notify the Consultant 14 working days in advance that the assembly is ready for testing.

.3 Factory testing shall include making final settings and configuration of EtherNet/IP system and devices and other programmable or field-configurable components.

3.2 FIELD TESTING AND COMMISSIONING

.1 Operational Readiness Testing

.1 The Contractor shall inspect and test furnished equipment and associated systems for conformance to the contract documents, including equipment manufacture's recommendations, and readiness for operation. The test shall include the following as a minimum:

.2 Visually inspect for physical damage and proper installation

.3 Perform tests in accordance with manufacturer's instructions

.4 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.5 Perform tests that equipment is ready for operation

.6 Touch-up paint all chips and scratches with manufacturer-supplied paint and transfer remaining paint to Owner

.2 Contractor shall submit an operational readiness test report documenting all test results, including all assumptions, conditions, allowances and corrections made during the test. The report shall provide a listing of all modifications and adjustments made onsite to include any settings / parameters not identified as factory defaults within the equipment's O&M documentation. The test report shall include a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

3.3 FUNCTIONAL DEMONSTRATION TESTING

.1 Prior to scheduling functional demonstration testing the Contractor shall submit a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

.2 The Contractor shall completely demonstrate the functionality and performance of the equipment and associated systems in the presence of Owner and Engineer, observing and documenting complete compliance with the Contract Documents.

.3 The Contractor shall submit a written report documenting successful completion of functional demonstrating testing including all assumptions, conditions, allowances and corrections made during the test.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing

END SECTION

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P2	September 22, 2023	Issued for Tender	WW	BW
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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated, and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for uninterruptable power supplies.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results - Electrical.

1.3 REGULATORY REQUIREMENTS

.1 CSA International

.2 CSA C22.2 No 107.1 – Power Conversion Equipment

.3 CSA C22.2 No 107.2 – Battery Chargers

.4 CSA C22.2 No 107.3 – Uninterruptible Power Systems

.5 CSA C813.1 – Performance Test Methods for Uninterruptible Power Supplies

.6 IEC 62040 - Uninterruptible Power Systems (UPS)

.7 IEEE 1184 – IEEE Guide for Batteries for Uninterruptible Power Supply Systems

.8 IEEE C62.41.1 – IEEE Guide on the Surge Environment in Low Voltage (1000V or less) AC Power Circuits

.9 IEEE C62.41.2 – IEEE Recommended Practice on Characterization of Surge in Low Voltage (1000V or less) AC Power Circuits

.10 NEMA PE1 - Uninterruptible Power Systems (UPS) – Specification and Performance Verification

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 STANDARD OF ACCEPTANCE

.1 Liebert GXT5-1500LVRT2UXL.

.1 Include IS-RELAY card

.2 Include wall mount kit WMBKT2U.

2.1 SYSTEM DESCRIPTION

.1 The UPS is to operate in conjunction with the electrical system to provide power conditioning and backup power protection for electronic equipment loads.

.2 System is to use normal power supply mains and battery to provide continuous, regulated sinusoidal AC power to isolated load.

.3 Equipment to operate continuously and unattended.

.4 Ensure that Uninterruptible Power Systems (UPS) is compatible with equipment that it feeds and with source from which it is fed.

2.2 PERFORMANCE

.1 Normal Mode:

.1 The rectifier shall derive power as needed from the commercial AC utility and supply filtered and regulated DC power to the on-line inverter. The inverter shall convert the DC power at its input to highly regulated and filtered AC power for the critical loads.

.2 Battery Mode:

.1 Upon complete failure of utility power, the UPS shall provide power to the critical loads through the inverter, from the internal or extended batteries. When utility power returns, the unit shall return to Normal operation.

.3 By-Pass Mode:

.1 The automatic bypass shall transfer the critical load to the commercial AC source, bypassing the UPS's inverter/rectifier, in the case of an overload, load fault, or internal failure.

.4 Standby Mode:

.1 When initially attached to a utility or other power source, the UPS shall start in standby mode until the user initiates power to the critical load. In this mode, the UPS shall recharge the batteries, but power shall not be supplied to the critical load.

2.3 UNINTERRUPTIBLE POWER SYSTEM

.1 Input power:

.1 Voltage and phase as indicated on Contract Drawings.

.2 Normal supply from AC mains.

.2 Output power:

.1 Voltage and phase as indicated on Contract Drawings.

.2 The UPS shall attempt to clear overloads while remaining on inverter in normal operation before transferring to bypass.

.3 Frequency - nominal 60 Hz:

.4 Duration of full load output after mains failure not less than [15] minutes

.5 Output voltage control:

.1 Continuously adjustable on load at least 5% from rated value.

.2 Voltage regulation: voltage not to change by more than 2% as load increases gradually from zero to 100%, or for specified duration of full load after mains failure.

.3 Transient voltage change not to exceed +/-10% of rated voltage upon 50% sudden load change, loss or return of AC input voltage to system when fully loaded or transfer of full load from inverter to bypass and vice versa, and return to normal within 3 Hz.

2.4 BATTERY

.1 Hot swappable internal batteries.

.2 Discharge current to supply inverter at full load output for 15 minutes.

2.5 DISPLAY AND CONTROLS

.1 The UPS shall be provided with a full graphical LCD display that provides the information and access to all settings and control features of the UPS.

.2 The main status screen shall include all the following information at a single view

.1 UPS mode status

.2 Load information:

.1 Load wattage

.2 Load VA

.3 Load percentage

.4 Graphical representation of load %

.3 Battery Condition

.1 Battery charge percentage

.2 Estimated runtime

.3 Number of EBMs connected

.4 Graphical representation of battery %

.4 Alert / Alarm conditions

.5 Efficiency

Part 3 Execution

3.0 INSTALLATION

.1 Locate UPS cubicles as indicated.

.2 Assemble and interconnect components to provide complete UPS as specified.

.3 Connect AC mains to main input terminal.

.4 Connect UPS output to load.

.5 Start-up UPS and make preliminary tests to ensure satisfactory performance.

3.1 TESTING

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical, Technical Specification 26 05 10 Testing and Commissioning, and CAN/CSA-C813.1.

.2 Provide:

.1 Competent field personnel to perform test, adjustments and instruction on UPS equipment.

.3 Tests:

.1 Inspection of cubicles.

.2 Inspection of electrical connections.

.3 Inspection of installation of remote mode lights and alarms.

.4 Demonstration of system start-up and shut-down.

.5 Run UPS for minimum period of 4 hours at full rated load to demonstrate proper operation with AC mains input and no AC input.

.6 Discharge battery by operating UPS with AC mains open for specified duration of full load. Record readings of temperature of each cell.

.7 Recharge battery automatically with full rated load on UPS for 4 hours and record readings of voltage of each cell.

END SECTION

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

1.2 REGULATORY REQUIREMENTS

.1 American National Standards Institute (ANSI)

.1 ANSI C78.374-2015 Light-Emitting Diode Package Specification Sheet for General Illumination Applications

.2 ANSI C78.377-2015 American National Standard for Electric Lamps—Specifications for the Chromaticity of Solid-State Lighting (SSL) Products

.2 Illuminating Engineering Society (IES)

.1 IES LM-79-08: Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

.2 IES LM-80-15: Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

.3 IES LM-82-12: LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

.4 IES LM-84-14: Approved Method for Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires

.5 IES LM-85-14: Approved Method for Electrical & Photometric Measurements of High Power LEDs

.6 IES TM-21-11: Projecting Long Term Lumen Maintenance of LED Light Sources

.7 IES TM-28-14: Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires

.8 IES TM-30-15: IES Method for Evaluating Light Source Color Rendition

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41.1-2002 (R2008), IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits

.2 ANSI/IEEE C62.41.2-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits

.4 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

.5 ICES-005-2016, Lighting Equipment

.6 National Electrical Manufacturers Association (NEMA)

.1 NEMA SSL 1-2010 Electronic Drivers for LED Devices, Arrays, or Systems

.7 Underwriters' Laboratories of Canada (ULC)

.1 UL 1449 (2014), Standard for Surge Protective Devices

1.3 SCOPE

.1 Materials and installation of lighting.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 INTERIOR LIGHT FIXTURE

.1 LED, 120V

.2 5000K color temperature.

.3 80 Color Rendering Index.

.4 4000 Lumens

.5 Gasketed, vapour-tight

.6 Ceiling or chain mounted.

.1 Include all necessary connectors.

.7 Standard of Acceptance: Cooper – Metalux 4VT2-LD5-4-DR100-UNV-L850-CD1-WL or approved equal.

2.1 EXTERIOR LIGHT FIXTURE

.1 LED, 120V

.2 4000K color temperature.

.3 80 Color Rendering Index.

.4 1396 Lumens

.5 Wall mounted.

.1 Include all necessary connectors.

.6 Standard of Acceptance: Cooper – XTOR1B-W or approved equal.

2.2 EXTERIOR FLOOD LIGHT

.1 LED, 120V

.2 4000K color temperature.

.3 Wall mounted.

.1 Include all necessary connectors.

.4 Standard of Acceptance: Cooper – GLEON-SA4-A-740-U-T3-ADJA-WM-BK or approved equal.

Part 3 Execution

3.0 INSTALLATION

.1 Locate and install luminaires as indicated in Contract Drawings.

3.1 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated in Contract Drawings.

3.2 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END SECTION

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1.1 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.2 REGULATORY REQUIREMENTS

.1 Illuminating Engineering Society (IES)

.2 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141, Emergency Lighting Equipment.

1.3 SCOPE

.1 Materials and installation of lighting.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

1.0 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 VAC.

.3 Output voltage: 3.6 VDC.

.4 Operating time: 90 minutes.

.5 Battery: sealed, maintenance free, wattage to suit load or as indicated.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid-state transfer circuit.

.8 Low voltage disconnect solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for:

.1 Battery Failure

.2 Battery Disconnected

.3 Charger Failure

.4 Lamp Failure

.5 Service Alarm

.6 AC Power ON

.7 High Charge

.10 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 1 W, minimum 10.76 lumen minimum output.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

Part 3 Execution

3.0 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment with minimum #10 AWG size wiring.

3.1 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized in accordance with manufacturer's recommendations.

3.2 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END SECTION

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Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results – Electrical

.2 Technical Specification 26 05 10 – Testing and Commissioning

.3 Technical Specification 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets

.4 Technical Specification 26 27 16 – Electrical Cabinets and Enclosures

1.2 REGULATORY REQUIREMENTS

.1 Not Used

1.3 SCOPE

.1 Materials and installation for heating and ventilation systems.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 CONTROLS

.1 Refer to electrical Contract Drawings for details on heating and ventilation control.

.2 Provide control equipment as shown on electrical Contract Drawings. Devices to be industrial quality, line voltage (120/240 volts), single-pole, white unless otherwise indicated on the Contract Drawings.

.3 Provide clear plastic thermostat guard for all heating/cooling wiring devices: thermostats, astronomical time switch.

2.1 HEATERS

.1 Element: Durable tubular heating element with fins.

.2 Finish: Epoxy-polyester powdercoat.

.3 Installation: Wall mounted

.4 Wattage & Voltage: As indicated on Contract Drawings

.5 Control: External thermostat.

.6 Heaters shall be suitably shielded to prevent accidental burning.

.7 There shall be no exposed electrical parts.

.8 Standard of Acceptance: Ouellet OAS Series or approved equal.

2.2 VENTILATION

.1 Building Ventilation

.1 Ventilating louvers shall be vermin, insect and rainproof with easily replaceable fiberglass, non-circular automotive type filters.

.2 Ventilation louvres shall be adequately sized and die punched.

.3 The Mechanical and Chemical Rooms shall be equipped with one or more 120/208VAC exhaust fans. Refer to Mechanical Drawings and Specifications for further details.

.4 Electrical connections shall be by two insulated spade connectors.

.5 There shall be no exposed electrical parts.

.6 Fans shall be covered with a protective guard.

.7 Fans shall be serviceable and replaceable without having to remove any other components.

.8 Complete with option for 120V External Control Circuit.

.2 VFD Ventilation

.1 To ensure adequate heat dissipation, the VFD unit may include fan-assisted cooling such that it would not degrade the enclosure rating.

.2 Forced-air ventilation shall have front intake and exhaust channels.

.3 Cooling fans shall be automatically controlled to operate based on the cooling air demands of the drive controller.

2.3 THERMOSTAT

.1 Refer to the Contract Drawings for heating and ventilation controls.

.2 There shall be no exposed electrical parts.

.3 Control of heaters and fans shall be from a wall-mount thermostat.

.4 Standard of acceptance: Honeywell T775 2000 Series Temperature Controller or approved equivalent.

Part 3 Execution

3.0 INSTALLATION

.1 Mount heaters on wall as indicated on Contract Drawings.

.2 Electrically connect ventilation as shown in manufacturer's installation instructions.

.3 Install control equipment in locations indicated on Contract Drawings.

.4 Make power and control connections.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 10 – Testing and Commissioning.

.2 Ensure that heaters, ventilation and controls operate correctly.

END SECTION

SECTION 31 11 01S
CLEARING AND GRUBBING

3.0.2 Execution	**Add Clause 3.0.2** .2S Contractor to remove trees outside of the nesting bird season of April 1 to September 1. Tree removal within this window will require authorization from the Professional Biologist.

SECTION 33 11 01
WATERWORKS

1. GENERAL	**ADD CLAUSE 1.3:** .3S Waterworks installed as part of RMOW SWWS Phase 1 are to be re-flushed, pressure tested and bacteriologically tested prior to tie-in by the Contractor. Costs for this test to be included in the project costs. Work associated with reviewing, correcting, and retesting will be additional cost addressed through GC 7.0.
3.17 GENERAL PROCEDURE FLUSHING, TESTING, AND DISINFECTION	**REPLACE CLAUSE 3.17.2 WITH THE FOLLOWING:** .2S Perform all tests in the presence of Contract Administrator and Municipal representative. Notify Contract Administrator 72 h in advance of proposed test. **ADD CLAUSE 3.17.7:** .7S The Contractor is required to submit a written testing and flushing procedure for approval from the Municipality and Contract Administrator. The procedure must be submitted a minimum of two weeks prior to performing pressure and chlorination testing. At a minimum the testing procedure is to include the following: .1 Water source locations .2 Water discharge points .3 Expected test dates for pressure testing, initial chlorination, chlorine residual testing, flushing and collection of water samples for laboratory testing .4 Segments of watermain to be tested .5 Chlorination methods .6 Chlorine level determination method .7 Bacterial testing laboratory used

3.19 TESTING PROCEDURES

REPLACE CLAUSE 3.19.2 WITH THE FOLLOWING

.2S Before pipe is filled with water, pipe bedding, concreting of all valves and fittings and backfilling to be completed as required in this specification. Fill each section of pipe and allow to remain full of water for a period of at least 24 hours prior to commencement of any pressure tests. Submit pipeline to a test of as noted in the Table below with a minimum of 200 psi applied at lowest point of test section. Ensure that test pressure does not exceed pipe or thrust restraint design pressures. Maximum allowable leakage rate at test pressure to not exceed 1.25 litres per millimeter diameter of pipe per kilometer per 24 hour period. Minimum duration of test period to be 2 hours.

Pipe Designation	Working Pressure	Test Pressure[1]
WRR	175 psi	260 psi
WRS	175 psi	260 psi
WVS	250 psi	375 psi
WW	150 psi	260 psi

1. Test pressure as recorded at P291

3.23 CONNECTIONS TO EXISTING MAINS

REPLACE CLAUSE 3.23.1 WITH THE FOLLOWING:

.1S Watermain tie-ins will only be completed after hydrostatic testing, disinfection, flushing, testing and acceptance by the Owner. Tie-ins to be completed by the Contractor and witnessed by the Owner. Tie-ins to be disinfected per AWWA C651 by the Contractor.

SECTION 40 05 00

PIPE AND PIPE FITTINGS - BASIC REQUIREMENTS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

- .1 Process piping systems.
- .2 Utility piping systems.
- .3 Plumbing piping systems.

.2 Related Specification Sections include but are not necessarily limited to:

- .1 Division 00 - Bidding Requirements, Contract Forms, and Conditions of Contract.
- .2 Division 01 - General Requirements.
- .3 Section 31 23 01 – Excavating, Trench and Backfilling.
- .4 Section 40 05 07 - Pipe Support Systems.
- .5 Section 40 05 23 – Pipe – Stainless Steel.
- .6 Section 40 05 31 – Pipe – Plastic.
- .7 Section 40 05 33 – Pipe – ECTFE.
- .8 Section 40 05 51 - Valves: Basic Requirements.
- .9 Section 40 05 52 - Miscellaneous Valves
- .10 Section 40 41 13 - Heat Tracing Cable.
- .11 Section 40 42 00 - Pipe, Duct and Equipment Insulation.
- .12 Section 40 73 00 - Pressure Instrumentation.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

- .1 American Society of Mechanical Engineers (ASME):
  - .1 B16.3, Malleable Iron Threaded Fittings.
  - .2 B16.5, Pipe Flanges and Flanged Fittings.
  - .3 B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
  - .4 B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
  - .5 B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .6 B31.1, Power Piping.
  - .7 B31.3, Process Piping.
  - .8 B36.19, Stainless Steel Pipe.
  - .9 B40.100, Pressure Gauges and Gauge Attachments.
- .2 American Iron and Steel Institute (AISI).
- .3 ASTM International (ASTM):

.1 A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 A74, Standard Specification for Cast Iron Soil Pipe and Fittings.

.3 A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

.4 A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.5 A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

.6 A197, Standard Specification for Cupola Malleable Iron.

.7 A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.8 A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.9 A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.10 A518, Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.

.11 A536, Standard Specification for Ductile Iron Castings.

.12 A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.

.13 A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.

.14 A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

.15 A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

.16 B88, Standard Specification for Seamless Copper Water Tube.

.17 C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

.18 C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

.19 C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.

.20 C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.21 C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.22 C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

.23 D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.24 D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

.25 D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

.26 D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.

.27 F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.28 F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

.4 American Water Works Association (AWWA):

.1 B300, Standard for Hypochlorites.

.2 C200, Standard for Steel Water Pipe - 6 IN and Larger.

.3 C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.

.4 C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.

.5 C220, Standard for Stainless-Steel Pipe, ½ In. (13 mm) and Larger.

.6 C226, Standard for Stainless-Steel Fittings for Waterworks Service, Sizes ½ in. Through 72 in. (13 mm Through 1,800 mm).

.7 C228, Standard for Stainless-Steel Pipe Flange Joints for Water Service – Sized 2 in. Through 72 in. (50 mm Through 1,800 mm).

.8 C504, Standard for Rubber Seated Butterfly Valves

.9 C509, Standard for Resilient-Seated Gate Valves for Water Supply Service

.10 C515, Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

.11 C606, Standard for Grooved and Shouldered Joints.

.12 C651, Standard for Disinfecting Water Mains.

.13 C800, Standard for Underground Service Line Valves and Fittings.

.5 American Water Works Association/American National Standards Institute (AWWA/ANSI):

.1 C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.

.2 C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.3 C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

.4 C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

.5 C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.

.6 Underwriters Laboratories, Inc. (UL).

.7 Canadian Standards Association (CSA)

.1 B137.1, Standard for Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.2 B137.2, Standard for Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications.

.3 B137.3, Standard for Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications.

.4 B137.5, Standard for Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.5 B137.6, Standard for Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot and Cold-Water Distribution Systems.

.8 NSF International (NSF).

.9 Building Codes:

.1 BC Building Code.

.2 National Building Code.

.10 Safety Regulations:

.1 WorkSafeBC.

.2 Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 DEFINITIONS

.1 HPIC: High performance industrial coating.

.2 PVC: Polyvinyl Chloride.

.3 PVDF: Polyvinylidene fluoride.

.4 HDPE: High Density Polyethlene.

.5 ECTFE: Ethylenechlorotrifluoroethylene.

.6 See Section 3.5, SCHEDULES, for more acronyms and definitions.

1.4 SYSTEM DESCRIPTION

.1 Piping Systems Organization and Definition:

.1 Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.

.2 See PIPING SPECIFICATION SCHEDULES in PART 3.

1.5 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.

.3 Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.

.1 Attach technical product data on gaskets, pipe, fittings, and other components.

.3 Schedule Fabrication and/or Layout Drawings:

.1 Exterior yard piping drawings with information including:

.1 Dimensions of piping lengths.

.2 Invert or centerline elevations of piping crossings.

.3 Acknowledgement of bury depth requirements.

.4 Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.

.5 Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.

.6 Line slopes and vents.

.2 Interior piping drawings with information including:

.1 Dimensions of piping from column lines or wall surfaces.

.2 Invert dimensions of piping.

.3 Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.

.4 Location and type of pipe supports and anchors.

.5 Locations of valves and valve actuator type.

.6 Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.

.7 Acknowledgement of valve, equipment and instrument tag numbers.

.8 Provisions for expansion and contraction.

.9 Line slopes and air release vents.

.10 Rough-in data for plumbing fixtures.

.3 Schedule of interconnections to existing piping and method of connection.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

.3 Informational Submittals:

.1 Qualifications of lab performing disinfection analysis on water systems.

.2 Test reports:

.1 Copies of pressure test results on all piping systems.
.2 Reports defining results of dielectric testing and corrective action taken.
.3 Disinfection test report.
.4 Notification of time and date of piping pressure tests.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Protect pipe during handling using methods recommended by manufacturer.
.1 Use of bare cables, chains, hooks, metal bars or narrow skids in contact with pipe is not permitted.

.2 Prevent damage to pipe during transit.
.1 Repair abrasions, scars, and blemishes.
.2 If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
.1 Insulating unions:
.1 "Dielectric" by Epco.
.2 Dirt strainers (Basket or H-type):
.1 Cla-Val Model X43H.
.3 Dirt strainers (Y type):
.1 Mueller (#351).
.2 Sarco.
.3 Armstrong.
.4 Chemical strainers (Y type):
.1 Chemline.
.2 Hayward.
.3 Chemtrol.
.4 Asahi.
.5 Dry disconnect couplings:
.1 Kamlock.
.6 Dielectric flange kit:
.1 PSI.
.2 Maloney.
.3 Central Plastics.
.7 Harness Restraint

.1 Romac AWWA M-11.

.8 Mechanical grooved type coupling:

.1 Victaulic

.9 Two-Bolt Stainless Steel Restrained Couplings:

.1 Robar

.2 Romac

.3 Straub.

.10 Expansion joint at FRP tanks:

.1 PROCO, Series 440.

.2 Garlock, Style 215.

.11 Flexible pipe connection at FRP tanks:

.1 Snyder, Masterflex HDPE

.12 Pressure gauges

.1 USG 656-6C

.2 ENFM 7211

.3 Wika 213.53

.4 Winters LF

.5 NuovaFima 18/3-A4.

.2 Submit request for substitution in accordance with Specification Section 01 25 00.

2.2 PIPING SPECIFICATION SCHEDULES

.1 Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Specification Section.

2.3 COMPONENTS AND ACCESSORIES

.1 Insulating Components:

.1 Dielectric flange kits:

.1 Flat faced.

.2 3mm (1/8 IN) thick dielectric gasket, phenolic, non-asbestos.

.3 Suitable for 1207 kPa, 100 DEGC.

.4 1.5mm (1/32 IN) wall thickness bolt sleeves.

.5 3mm (1/8 IN) thick phenolic insulating washers.

.2 Dielectric unions:

.1 Screwed end connections.

.2 Rated at 1207 kPa , 100 DEGC.

.3 Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.

.2 Dirt Strainers - Basket or H type.

.1 Composition: ductile iron.
.2 Pressure rating: 400 psi.
.3 20 mesh Monel screen.
.4 Ball valve and provided at blowoff outlet. Valve to be same diameter as blowoff outlet.
.5 Flanged end connections.
.6 Fusion bonded epoxy coating and lining.
.7 NSF/ANSI 61 approved.

.3 Dirt Strainers:
.1 Y-type.
.2 Composition: bronze.
.3 Rated for test pressure and temperature of system in which they are installed.
.4 20 mesh Monel screen.
.5 Come with purge valve in the blowoff outlet.
.6 Threaded NPT end connections.

.4 Strainers for Chemical Applications:
.1 Y-type.
.2 Strainers of same material, test pressure, and temperature rating as piping system in which strainer is placed.

.5 Reducers:
.1 Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
.2 Connection size requirements may change from those shown on Drawings depending on equipment furnished.

.6 Protective Coating and Lining:
.1 Include pipe, fittings, and appurtenances where coatings, linings, coating, tests and other items are specified.
.2 Field coating pipe in accordance with Specification Section 09 96 00.

.7 Two-Bolt Stainless Steel Restrained Couplings:
.1 Center sleeve and end rings to be stainless steel.
.2 Gaskets to be NBR.
.3 Fasteners to be stainless steel.

.8 Dry Disconnect Couplings:
.1 Adapters:
.1 Male adapters: Size shown on Drawings.
.2 Adapters:
.1 Female NPT end connection for flush applications.

.2 Male NPT end connection for chemical applications.

.3 Construct adapters for chemical and PVC system applications 3 IN and below from polypropylene.

.1 Above 3 IN size, provide stainless steel units.

.2 Couplers:

.1 Built-in valve and spring loaded poppet which close automatically when disconnected.

.2 Designed to remain with only one arm locked in closed position.

.3 Construct couplers for chemical and PVC system applications 3 IN and less from polypropylene with stainless steel arms and pins.

.1 Above 3 IN, provide stainless steel units.

.4 Gasket: Compatible with conveyed liquid.

.3 Dust caps: For all adapters.

.9 Expansion Joints at FRP:

.1 Materials:

.1 Bellows: PTFE-62.

.2 Flanges: PVC, steel.

.3 Limit bolts and nuts: 316 stainless steel.

.4 Reinforcing rings: Stainless steel.

.2 Pressure rating at 21 DEGC: 483 kPa.

.3 Minimum axial movement: 9.5 mm.

.10 Flexible pipe connection:

.1 Material: HDPE

.2 Diameter: 50mm

.3 Connection: ANSI Flange x Flange

.4 Snyder Industries Flexmaster 5390100N95401

.11 Pressure gauges:

.1 Each gauge connection shall be provided with a 15 mm, stainless steel, lever operated isolating ball valve.

.2 Mounted atop this shall be a piston & rod type snubber, Ray Model 060B approved, to which a liquid-filled pressure gauge shall be installed. The small rod is to be inserted into the snubber.

.3 Gauges shall have a minimum 100mm dial, 15 mm MNPT bottom connection of stainless steel or brass and a dual scale psi and kPa readings. Gauge range 0-689kPa (0-100 psi).

.4 Isolating valve and installation fittings shall be stainless steel and hex nipples, not close type, shall be utilized.

.12 Mechanical grooved type coupling:

.1 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer (Victaulic). Grooving tools shall be of the same manufacturer as the grooved components (Victaulic).

.2 Rigid couplings:

.1 Victaulic Style 07, 107V and Style W07, ductile iron coupling with a fusion bonded epoxy coating (safety blue) direct from manufacturer, for steel piping systems.

.2 Victaulic Style 89 and Style W89, ductile iron coupling with hot dipped galvanized coating, for stainless steel piping systems.

.3 Victaulic Style 807N, ductile iron coupling for Potable Water on stainless steel piping systems.

.4 Victaulic Style 489, 316 stainless steel couplings for submerged or for corrosive conditions, for stainless steel piping systems.

.5 Victaulic Style 31, ductile iron coupling with a coal tar epoxy coating, for ductile iron piping systems, class 53 or higher.

.6 Victaulic Style 307, ductile iron coupling with a coal tar epoxy coating, for transitions from ductile iron piping class 53 or higher to IPS steel/stainless steel piping systems.

.3 Flexible couplings:

.1 Victaulic Style 77, 177N and Style W77, ductile iron coupling with a fusion bonded epoxy coating (safety blue) direct from manufacturer, for steel piping systems.

.2 Victaulic Style 77S, 316 stainless steel coupling for submerged or for corrosive conditions, for stainless steel piping systems.

.3 Victaulic Style 877N ductile iron coupling for Potable Water on stainless steel piping systems.

.4 Victaulic Style 475, 316 stainless steel coupling for submerged or for corrosive conditions, for stainless steel piping systems.

.4 Coupling gaskets:

.1 Grade E “EDPM” Standard type for water from -34°C to +110°C

.2 Grade E “EDPM” FlushSeal type, suitable for vacuum service

.3 Grade P “Fluoroelastomer” Installation Ready type for Potable Water services.

.5 Bolts and nuts:

.1 Stainless steel Type 304 for submerged or for corrosive conditions.

.2 Standard Carbon Steel Zinc Electroplated for non-corrosive environments.

.6 Victaulic Fittings

.1 Steel to ASTM A106 Grade B – segmentally welded

.2 Ductile Iron to ASTM A536, grade 65-45-12

.3 ASTM A403 Type 304 or 316 stainless steel

.7 Victaulic Flanges

.1 Style 741 and Style W741, ductile iron flange adapter, for steel piping systems.

.2 Flange adapters shall not be used on stainless steel piping systems.

.8 Victaulic Grooves

.1 Steel Pipe: roll grooved using standard grooving rolls to Victaulic specifications, or cut grooved where piping thicknesses allow to Victaulic specifications.

.2 Light Wall Stainless Steel Pipe, schedule 5S and 10S: roll grooved to Victaulic specifications using "RX" roles.

.3 Standard Wall Stainless Steel Pipe, greater than schedule 10S: roll grooved using standard grooving rolls to Victaulic specifications, or cut grooved where piping thicknesses allow to Victaulic specifications.

.4 Standard grooving rolls or cut grooving tools shall be dedicated for the use on stainless steel pipe or be thoroughly cleaned to prevent groove contamination and corrosion.

.5 Rigid Radius Cut Grooving and Flexible Radius Cut Grooving for use on Ductile Iron Pipe Class A53 or higher to Victaulic specifications.

.13 Valves:

.1 See schematics and details for definition of manual valves used in each system under 100mm (4 IN) in size.

.2 See Drawings schedule for valve types 100mm (4 IN) and above and for automatic valves used in each system.

.3 See Specification Section 40 05 51.

3. EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

.1 Unless otherwise shown on the Drawings, provide a minimum of 1.8 m earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.

.2 Enter and exit through structure walls, floors, and ceilings by using penetrations and seals with Linkseal, Grouting or cast-in-pace and as shown on Drawings.

.3 Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

.1 Install piping in vertical and horizontal alignment as shown on Drawings.

.2 Alignment of piping smaller than 100mm may not be shown; however, install according to Drawing intent and with clearance and allowance for:

.1 Expansion and contraction.

.2 Operation and access to equipment, doors, windows, hoists, moving equipment.

.3 Headroom and walking space for working areas and aisles.

.4 System drainage and air removal.

.3 Enter and exit through structure walls, floor and ceilings using penetrations and seals as shown on the Drawings and as specified.

.4 Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

.5 Pipe Supports:

.1 Use methods of piping support as shown on Drawings and as required in Specification Section 40 05 07.

.2 Size pipe supports with consideration to specific gravity of liquid being piped.

.6 Locate and size sleeves and castings required for piping system.

.1 Arrange for chases, recesses, inserts or anchors at proper elevation and location.

.7 Use reducing fittings throughout piping systems.

.1 Bushings will not be allowed unless specifically approved.

.8 Equipment Drainage and Miscellaneous Piping:

.1 Collect system condensate at drip pockets, traps and blowoff valves.

.2 Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.

.3 For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.

.1 Size to handle application with 15 mm being minimum size provided.

.9 Unions:

.1 Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.

.2 Mechanical type couplings may serve as unions.

.3 Additional flange unions are not required at flanged connections.

.10 Install expansion devices as necessary to allow expansion/contraction movement.

.11 Anchorage and Blocking:

.1 Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.

.12 Provide full face gaskets on all systems.

.13 Provide insulating components where dissimilar metals are joined together.

.14 Equipment Pipe Connections:

.1 Equipment - General:

.1 Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.

.2 Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.

.1 Provide tightening torque in accordance with manufacturer's recommendations.

.3 Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.

.4 Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.

.5 Align, level, and wedge equipment into place during fitting and alignment of connecting piping.

.6 Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.

.7 To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.

.1 Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.

.2 Realign as necessary, install flange bolts and make equipment connection.

.8 Provide insulating components where dissimilar metals are joined together.

.9 Provide utility connections to equipment shown on Drawings, scheduled or specified.

.2 Non-Potable Water Plumbing:

.1 Make piping connections to plumbing, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.

.2 Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or as integral part of equipment.

.3 For each water supply piping connection to equipment, furnish and install union and gate or angle valve.

.1 Provide wheel handle stop valve at each laboratory sink water supply.

.2 Minimum size: 15 mm.

.4 Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system.

.1 Size trap as required by National Plumbing Code.

.5 Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed.

.15 Instrument Connections:

.1 See drawing details.

3.3 CATHODIC PROTECTION

.1 Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete slabs, other pipe lines, and miscellaneous metal.

.2 Make all connections from wire or cable by Thermit Cadwelding accomplished by operators experienced in this process.

.3 Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50% of the straight line length.

.4 After cadwelding, coat all exposed metallic surfaces with hot applied tape.

3.4 HEAT TRACING

.1 See Specification Section 40 41 13 - Heat Tracing Cable.

3.5 PRESSURE GAUGES

.1 Provide at locations shown on the Drawings and specified.

3.6 FIELD QUALITY CONTROL

.1 Pipe Testing - General:

.1 Test piping systems as follows:

.1 Test exposed, non-insulated piping systems upon completion of system.

.2 Test exposed, insulated piping systems upon completion of system but prior to application of insulation.

.1 Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.

.2 Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.

.2 Utilize pressures, media and pressure test durations as specified in the PIPING SPECIFICATION SCHEDULES.

.3 Isolate equipment which may be damaged by the specified pressure test conditions.

.4 Perform pressure test using calibrated pressure gauges and calibrated volumetric measuring equipment to determine leakage rates.

.1 Select each gauge so that the specified test pressure falls within the upper half of the gauge's range.

.2 Notify the Engineer 24 HRS prior to each test.

.5 Completely assemble and test new piping systems prior to connection to existing pipe systems.

.6 Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.

.7 Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

.2 Pressure Testing:

.1 Testing medium: Unless otherwise specified in the PIPING SYSTEMS SCHEDULE, utilize the following test media.

.1 Process and plant air systems:

PIPE LINE SIZE	SPECIFIED TEST PRESSURE	TESTING MEDIUM
50mm and smaller	517 kPa or less	Air or Water
50mm and smaller	Greater than 517 kPa	Water
Greater than 50mm	21 kPa or less	Air or Water
Greater than 50mm	Greater than 21 kPa	Water

.2 Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 1200mm	Gravity	172 kPa or less	Water
Above 1200mm	Gravity	172 kPa or less	Water
PW Suction	Gravity	1,850 kPa	Water
PW Discharge	Pumped	2,600 kPa	Water
CS	Pumped	1,500 kPa	Water
Unless Otherwise Noted		1,500 kPa	Water

.2 Allowable leakage rates:

.1 Exposed piping systems, all pressure piping systems and all buried which are hydrostatically pressure tested shall have zero leakage goal at the specified test pressure throughout the duration of the test. Allowable leakage per AWWA C600.

.3 Hydrostatic pressure testing methodology:

.1 General:

.1 All joints, including welds, are to be left exposed for examination during the test.

.2 Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.

.3 Provide temporary restraints for expansion joints for additional pressure load under test.

.4 Isolate equipment in piping system with rated pressure lower than pipe test pressure.

.5 Do not coat or insulate exposed piping until successful performance of pressure test.

.2 Soil, waste, drain and vent systems:

.1 Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.

.2 Eliminate leaks before proceeding with work or concealing piping.

.3 Minimum test heights shall be 3m above highest stack inlet.

.3 Dielectric Testing Methods and Criteria:

.1 Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous elements of construction to assure discontinuity has been maintained.

.2 Wherever electrical contact is demonstrated by such test, locate the point or points of continuity and correct the condition.

3.7 CLEANING, DISINFECTION AND PURGING

.1 Cleaning:

.1 Clean interior of piping systems thoroughly before installing.

.2 Maintain pipe in clean condition during installation.

.3 Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.

.4 Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.

.5 At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.

.1 Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, or other foreign material which may have accumulated by operation of system, from testing, or from other causes.

.2 Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

.2 Disinfection of Potable Water Systems:

.1 After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.

.2 Perform work, including preventative measures during construction, in full compliance with AWWA C651.

.3 Perform disinfection using sodium hypochlorite complying with AWWA B300.

.4 Flush each segment of system to provide flushing velocity of not less than 1 m per second.

.5 Drain flushing water to sanitary sewer.

.1 Do not drain flushing water to receiving stream.

.6 Use continuous feed method of application.

.1 Tag system during disinfection procedure to prevent use.

.7 After required contact period, flush system to remove traces of heavily chlorinated water.

.8 After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.

.1 Repeat entire disinfection procedures until satisfactory results are obtained.

.9 Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.

.1 Ensure sampling and testing procedures are in full compliance to AWWA C651, local water purveyor and applicable requirements of British Columbia.

.10 All piping with the following designation shall be disinfected:

.1 PW – Potable Water

.2 CS – Caustic Solution

.3 NPW – Non Potable Water

.4 PWC – Potable Water Cold

.5 PWH – Potable Water Hot

.6 PTW – Potable Water Tepid

3.8 LOCATION OF BURIED OBSTACLES

.1 Furnish exact location and description of buried utilities encountered and thrust block placement.

.2 Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.

.3 Include such information as location, elevation, coverage, supports and additional pertinent information.

.4 Incorporate information on "As-Recorded" Drawings.

3.9 PIPE INSULATION

.1 Insulate pipe and pipe fittings in accordance with Specification Section 40 42 00.

3.10 PIPING SYSTEM SCHEDULES

Abbreviation	Service	Size and Material[1]	System Number
PW	Potable Water	15mm to 300mm	1
NPW	Non Potable Water	15mm to 100mm	1

Abbreviation	Service	Size and Material[1]	System Number
CSS	Caustic Sidestream	15mm to 100mm	1
CS	Caustic Solution	15mm to 100mm	2
OF	Overflow	50mm to 300mm	3
CV	Caustic Vent	50mm to 300mm	3
CA	Compressed Air	15mm to 50mm	4

Notes:

.1 Once a piping system is selected for a run of pipe, the piping material shall remain the same unless prior approval is given by the Engineer.

3.11 PIPING SYSTEM SCHEDULES

.1 SPECIFICATION SCHEDULE – SYSTEM 1

.1 General:

.1 Piping symbol and service:

.1 PW - Potable Water.

.2 NPW – Non Potable Water

.3 CSS – Caustic Sidestream.

.2 Test requirements:

.1 Test medium: Water.

.2 Pressure:

.1 Gravity PW: 1,850 kPa.

.2 Pumped PW: 2,600 kPa.

.3 NPW: 1,000 kPa.

.4 SS: 1,000 kPa

.3 Duration: 6 HRS.

.3 Gaskets and O-rings:

.1 O-rings: Neoprene or rubber.

.2 Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.

.3 Flanged joints (steel): Rubber, AWWA C207.

.4 Grooved coupling joints (ductile and steel): Rubber, AWWA C606.

.5 NSF/ANSI 61 listed.

.2 System components:

.1 Pipe size to 25mm:

.1 Exposed service:

.1 Materials: Stainless steel tubing, TP-304L.

.2 Reference: ASTM A269.
.3 Lining: None.
.4 Coating: None.
.5 Fittings: Stainless steel 304L compression type tube fittings.
.6 Joints: Compression type couplings, unions at equipment and valves.

.2 Pipe size 32mm through 600mm:
.1 Exposed service:
.1 Materials:
.1 Threaded: Stainless Steel TP-304L, Schedule 40S.
.2 Welded: Stainless Steel TP-304L, Schedule 40S.
.3 Grooved: Stainless Steel TP-304L, Schedule 40S.
.2 Reference: ASTM A312.
.3 Lining: None.
.4 Coating: None.
.5 Fittings: conforming to ASTM A351, ASTM A182, and ASTM A403 as applicable.
.6 Joints:
.1 Threaded.
.2 Flanged or grooved type mechanical coupling (Victaulic) joints.
.3 Provide flanges at valves and equipment.
.4 With all systems, provide rigid flanges at equipment and valves above 50mm and unions at those locations 50mm and below. Provide rigid flanges or grooved connections at structure penetrations above 50mm and unions at those locations 50mm and below.
.2 Buried service:
.1 Materials: Stainless Steel TP-304L, Schedule 40S.
.2 Reference: ASTM A312.
.3 Lining: None.
.4 Coating: None.
.5 Fittings: Fittings: conforming to ASTM A351, ASTM A182, and ASTM A403 as applicable.
.6 Joints: welded at fitting and retrained as shown on drawings.
.3 Pipe joint cement permitted only on external threads.
.4 Anti-galling compound required on all threaded fittings
.3 For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use 304L, stainless steel pipe.

.2 Piping System 2 – Exposed ECTFE (Halar) Piping
.1 General:

.1 Piping symbol and service:
.1 CS – Caustic Solution
.2 Test requirements:
.1 Test medium: Water.
.2 Pressure:
.1 Test pressure to be 1.5 times the maximum working pressure measured at the lowest point in the pipe, or 690 kPa, whichever is greater. Duration: 2 HRS
.3 Gaskets:
.1 EPDM.
.4 Pipe size 25mm through 600mm:
.1 Exposed service:
.1 Material: ECTFE
.2 Reference: ASTM D3222.
.3 Lining: None.
.4 Coating: None.
.5 Fittings: Butt-fusion infrared welding method complying with ASTM D2657.
.6 Joints: Fusion welding at valves, penetrations through structures and equipment connections for pipe 50mm and less and flanges at those locations for pipe above 50mm.

.3 Piping System 3 – Exposed PVC Piping
.1 General:
.1 Piping symbol and service:
.1 OF – Overflow
.2 CV – Caustic Vent.
.2 Test requirements:
.1 Test medium: Water.
.2 Pressure:
.1 PVC and stainless steel: Test pressure to be 1.5 times the maximum working pressure measured at the lowest point in the pipe, or 100 kPa, whichever is greater. Duration: 2 HRS
.3 Gaskets:
.1 Rubber, AWWA C606.
.4 Pipe size 25mm through 600mm:
.1 Exposed service:
.1 Material: PVC, Type 1, Grade 1, Schedule 80.
.2 Reference: ASTM D1785.

.3 Lining: None.

.4 Coating: None.

.5 Fittings: Solvent welded socket type complying with ASTM D2467.

.6 Joints: Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 50mm and less and flanges at those locations for pipe above 50mm.

.7 Joining:

.1 The joining method shall be solvent cement welding.

.4 Piping System 4 – Compressed Air

.1 General:

.1 Piping symbol and service:

.1 CA – Compressed Air.

.2 Test requirements:

.1 Test medium: See the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.

.2 Pressure: 175 psig.

.3 Duration: 6 HRS.

.3 Gaskets and O-rings:

.1 O-ring and flanged joints: Rubber or neoprene, 250 DegF.

.2 Grooved coupling joints (steel): AWWA C606, rubber, 250 DegF.

.2 System components:

.1 Pipe size to 1 IN:

.1 Exposed service:

.1 Material: Stainless steel tubing, TP-304L.

.2 Reference: ASTM A269.

.3 Lining: None.

.4 Coating: None.

.5 Fittings: Stainless steel 304L, compression type tube fittings.

.6 Joints: Compression type couplings, unions at equipment and valves.

.2 Pipe size 1 IN to 4 IN:

.1 Exposed service:

.1 Materials:

.1 Threaded: Steel, Grade B, black, Schedule 40.

.2 Grooved type joint system: Use pipe thickness per AWWA C606.

.2 Reference: ASTM A53.

.3 Linings: None.

.4 Coating: Paint.

.5 Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.

.6 Joints:

.1 Threaded or grooved type mechanical coupling (AWWA C606) joints.

.2 With both systems, provide rigid flanges at equipment, valves and structure penetrations above 2 IN and unions at those locations 2 IN and below.

.2 Buried service:

.1 Materials: Steel, Schedule 40, Grade B, black.

.2 Reference: ASTM A53.

.3 Lining: None.

.4 Coating: Bituminous.

.5 Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.

.6 Joints: Threaded.

.3 Slope all piping mains approximately 1:100 toward points of drainage.

.4 Provide driplegs at low points:

.1 Provide ball type isolation valve.

.2 Route dripleg to nearest wall or column and terminate 4 FT above finished floor.

END OF SECTION

SECTION 40 05 07
PIPE SUPPORT SYSTEMS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Pipe support and anchor systems.

.2 Design of Pipe Support Systems as specified.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Society of Mechanical Engineers (ASME):

.1 B31.1, Power Piping.

.2 B31.3, Process Piping.

.2 ANVIL International (ANVIL).

.3 ASTM International (ASTM):

.1 A36, Standard Specification for Carbon Structural Steel.

.2 A276, Standard Specification for Stainless Steel Bars and Shapes.

.3 A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.

.4 A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.

.5 A917, Standard Specification for Steel Sheet, Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface (General Requirements).

.6 A918, Standard Specification for Steel Sheet, Zinc-Nickel Alloy Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.

.7 B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

.4 American Welding Society (AWS):

.1 D1.1, Structural Welding Code - Steel.

.2 D1.6, Structural Welding Code - Stainless Steel.

.5 Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

.1 SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 SP-69, Pipe Hangers and Supports - Selection and Application.

.2 Responsibility:

.1 Support systems for piping greater than 8 inches diameter are shown on the Drawings and are not to be designed by Contractor unless indicated in Contract Documents.

.2 Design complete support systems for piping 6 inches and smaller where supports are not shown on the Drawings.

.3 Refer to specification section 40 05 07.01 for ECTFE piping requirements.

.4 Provide all labour, materials, equipment and incidentals as shown, specified and required to design, furnish and install the system of hangers, supports, guidance, anchorage and appurtenances.

.5 General piping support details may be indicated on the Drawings.

.6 Incorporate those details with requirements of this Specification Section to provide the piping support system.

.3 Each type of pipe hanger or support shall be the product of one manufacturer.

.4 Qualifications:

.1 Pipe support designer:

.1 Licensed Professional Engineer registered in British Columbia.

.2 Minimum of five years experience designing pipe supports for projects of similar size and complexity.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 See 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 Product technical data including:

.1 Scaled drawings showing location, installation, material, loads and forces, and deflection of all hangers and supports.

.2 Analyze each pipe system for all loads and forces on hangers and supports and their reaction forces to the structure to which they are fastened.

.3 Where Contract Documents indicate contractor is to design pipe support systems, submit detail design calculations and scaled drawings signed by Pipe support designer.

.4 Product data:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.3 Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.

.3 Certifications.

.1 Pipe support designer qualifications

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 MANUFACTURED UNITS

.1 Floor mounted supports in rooms with tanks or aquaria or other water vessels that will have open water surfaces shall be stainless steel, aluminum or FRP with stainless steel fasteners unless noted otherwise in the Drawings. Supports inside the tanks and any supports within 3 ft of tanks or aquaria or other vessels that will have open water surface shall be stainless steel, aluminum or FRP or polymer with stainless steel fasteners unless noted otherwise in the Drawings.

.2 Outdoor supports not addressed in previous paragraph shall be galvanized or stainless, aluminum, FRP or polymer.

.3 General:

.1 Galvanized components:

.1 Electro-galvanized components:

.1 Bar, forged or cast fabrications: ASTM B633, SC4.

.2 Rolled sheet fabrications: ASTM A917 and ASTM A918, 50N50NU.

.2 Hot-dipped galvanized components: See Specification Section 05 50 00.

.2 Dissimilar metals protection:

.1 Galvanized-to-galvanized and galvanized-to-aluminum: No protection required.

.2 All other galvanized-to-dissimilar metal connections: Neoprene or nylon pads, shims, grommets, etc.

.4 Hanger Rods:

.1 Material:

.1 ASTM A36.

.2 ASTM A575, Grade M1020.

.3 ASTM A576, Grade 1020.

.4 Minimum allowable tensile stress of 12,000 PSI at 650 DEGF per MSS SP-58.

.5 Corrosion resistant: 304 or 316 stainless steel per ASTM A276.

.2 Continuously threaded.

.3 Electro-galvanized or cadmium plated after threads are cut.

.4 Load limit:

NOMINAL ROD DIAMETER	MAXIMUM SAFE LOAD
9.5 mm (3/8 IN) DIA (min)	277 kg (610 lb)
12.7 mm (1/2 IN) DIA	514 kg (1,130 lb)

NOMINAL ROD DIAMETER	MAXIMUM SAFE LOAD
15.9 mm (5/8 IN) DIA	823 kg (1,810 lb)
19.0 mm (3/4 IN) DIA	1,232 kg (2,710 lb)
22.2 mm (7/8 IN) DIA	1,714 kg (3,770 lb)
25.4 mm (1 IN) DIA	2,255 kg (4,960 lb)

.5 Hangers:

.1 Materials for corrosive areas: 304 stainless steel.

.2 Hangers for use directly on copper pipe: Copper or cadmium plated.

.3 Hangers for use other than directly on copper pipe: Cadmium plated or galvanized.

.4 Hanger type schedule:

APPLICATION	PIPE SIZE	HANGER TYPE
All except noted	100mm and less	ANVIL Figure 108 with Figure 114
All except noted	Over 100mm	ANVIL Figure 590
Steam, condensate and hot water	All	ANVIL Figure 181, Figure 82
Service in chemical storage areas and as indicated on drawings for corrosion resistance	All	CorPro CP - Hanger or equal

.6 Concrete Inserts for Hanger Rods:

.1 Continuous slots: Unistrut #P1000.

.2 Individual inserts: ANVIL Figure 281.

.3 See Specification Section 03 15 19, mechanical anchors.

.7 Beam Clamps for Hanger Rods:

.1 Standard duty.

.2 ANVIL Figure 133.

.8 Trapeze Hangers for Suspended Piping:

.1 General:

.1 Material: Steel.

.2 Galvanized.

.3 Angles, channels, or other structural shapes.

.4 Curved roller surfaces at support point corresponding with type of hanger required.

.2 In chemical storage and feed areas and as indicated on the drawings:

.1 Materials: FRP.

.2 Unistrut fiberglass channel or equal.

.9 Vertical Pipe Supports:
- .1 At base of riser.
- .2 Lateral movement:
  - .1 Clamps or brackets:
    - .1 ANVIL Figure 40.
    - .2 ANVIL Figure 195.

.10 Expanding Pipe Supports:
- .1 Spring hanger type.
- .2 MSS SP-58.

.11 Pipe Support Saddle:
- .1 For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings.
- .2 ANVIL Figure 264.

.12 Pipe Support Risers:
- .1 Schedule 40 pipe.
- .2 Size: As recommended by saddle manufacturer.

.13 Pipe Support Base Plate:
- .1 100 mm larger than support.
- .2 Collar 0.188 mm (3/16 IN) thickness, circular in shape, and sleeve type connection to pipe.
- .3 Collar fitted over outside of support pipe and extended 50 mm from floor plate.
- .4 Collar welded to floor plate.
- .5 Edges ground smooth.
- .6 Assembly hot-dipped galvanized after fabrication.

.14 Pipe Covering Protection Saddle:
- .1 For insulated pipe at point of support.
- .2 ANVIL Figure 167, Type B.

.15 Wall Brackets:
- .1 For pipe located near walls and 2.4m or more above floor elevation or as otherwise indicated on the Drawings.
- .2 ANVIL Figure 199.

.16 Pipe Anchors:
- .1 For locations shown on the Drawings.
- .2 6.4 mm (1/4 IN) steel plate construction.
- .3 Designed to prevent movement of pipe at point of attachment.

.17 Pipe Guides:

.1 For locations on both sides on each expansion joint or loop.

.2 To ensure proper alignment of expanding or contracting pipe.

.3 ANVIL Figure 256.

2.3 DESIGN REQUIREMENTS

.1 Supports capable of supporting the pipe for all service and testing conditions.

.1 Provide 5 to 1 safety factor.

.2 Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

.3 Piping support design for pumped system to also take into account water hammer forces that result from pumps operating at full speed when power is cut to the pumps.

.4 Design supports and hangers to allow for proper pitch of pipes.

.5 For chemical and waste piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:

.1 ASME B31.3.

.2 MSS SP-58 and MSS SP-69.

.3 Except where modified by this Specification.

.6 For steam and hot and cold water piping, design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors:

.1 ASME B31.1.

.2 MSS SP-58 and MSS SP-69.

.7 Check all physical clearances between piping, support system and structure.

.1 Provide for vertical adjustment after erection.

.8 Support vertical pipe runs in pipe chases at base of riser.

.1 Support pipes for lateral movement with clamps or brackets.

.9 Hangers are to be installed on outside of pipe insulation.

.1 Use a pipe covering protection saddle for insulated pipe at support point.

.2 Insulated piping 40mm and less:

.1 Provide a 225 mm (9 IN length) of high density perlite or high density calcium silicate at saddle.

.2 See Specification Section 40 42 00.

.3 Insulated piping over 40 mm: Provide a 300 mm (12 IN) length of high density perlite or high density calcium silicate at saddle.

.10 Provide 20 GA galvanized steel pipe saddle for fiberglass and plastic support points to ensure minimum contact width of 100 mm.

.11 Pipe Support Spacing:

.1 General:

.1 Factor loads by specific weight of liquid conveyed if specific weight is greater than water.

.2 Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.

.3 Provide at least one support for each length of pipe at each change of direction and at each valve.

.2 Steel, stainless steel, cast-iron pipe support schedule:

PIPE SIZES - mm	MAXIMUM SPAN - m
40 and less	1.5
50 thru 100	3.0
125 thru 200	4.5
250 and greater	6.0

.3 Copper pipe support schedule:

PIPE SIZES - mm	MAXIMUM SPAN - m
65 and less	1.5
75 thru 150	3.0
200 and greater	4.5

.4 PVC pipe support schedule:

PIPE SIZES - mm	MAXIMUM SPAN - m
32 and less	1
40 thru 75	1.2
100 and greater	1.5

* Maximum fluid temperature of 50 DEGC.

.5 Support each length and every fitting:

.1 Bell and spigot piping:

.1 At least one hanger.
.2 Applied at bell.

.2 Mechanical coupling joints:
.1 Place hanger within 0.6 m of each side of fittings to keep pipes in alignment.

.6 Space supports for soil and waste pipe and other piping systems not included above every 1.5 m.

.7 Provide continuous support for nylon tubing.

.8 For PVC, FRP and copper piping:
.1 Provide Unistrut Unicushion wrap of pipe at each support.

3. EXECUTION

3.1 INSTALLATION

.1 Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
.1 Included in this requirement are movements from:
.1 Trap discharge.
.2 Water hammer.
.3 Similar internal forces.

.2 Weld Supports:
.1 AWS D1.1.
.2 Weld anchors to pipe in accordance with ASME B31.3.
.3 AWS D1.6 for stainless steel supports.

.3 Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

.4 Inspect hangers for:
.1 Design offset.
.2 Adequacy of clearance for piping and supports in the hot and cold positions.
.3 Guides to permit movement without binding.
.4 Adequacy of anchors.

.5 Inspect hangers after erection of piping systems and prior to pipe testing and flushing.

.6 Anchorage to Concrete- reference Section 03 15 19.

.7 Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
.1 Install concrete inserts as concrete forms are installed.

.8 Welding:
.1 Welding rods: ASTM and AWS standards.
.2 Integral attachments:

.1 Include welded-on ears, shoes, plates and angle clips.

.2 Ensure material for integral attachments is of good weldable quality.

.3 Preheating, welding and postheat treating: ASME B31.3, Chapter V.

.9 Field Painting:

.1 Comply with Specification Section 09 96 00.

END OF SECTION

SECTION 40 05 07.01
PLASTIC PIPE SUPPORTS

1. GENERAL

1.1 SUMMARY

.1 This specification covers general and detailed requirements for the design, selection, and installation of non-restrictive plastic pipe supports for sizes ½" (20 mm) through 12" (315 mm) for above ground plastic piping.

1.2 QUALITY ASSURANCE

.1 Metal pipe supports and insert shall have the manufacturer's name, and applicable size stamped in the part for identification.

.2 Hangers and supports shall be designed and manufactured in conformance with MSS SP 58.

1.3 REFERENCED STANDARDS:

.1 ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel B

.2 ASTM A653 - Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process

.3 MSS SP58 - Manufacturers Standardization Society: Pipe Hangers and Supports-Materials, Design, and Manufacture

.4 MSS SP69 - Manufacturers Standardization Society: Pipe Hangers and Supports-Selection and Application

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Manufacture's technical information on hangers confirming compliance with this specification.

.2 Drawing showing final location of supports and hangers.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

.1 GF Piping System Stress Less Pipe Guides

.2 Spears CLIC.

2.2 PIPE HANGERS AND SUPPORTS

.1 Non- Restrictive Horizontal Pipe Clamps

.1 Plastic pipe supports shall be constructed of an exterior metal supporting bracket of gauge 11 to gauge 0 thickness, depending on size, and an independent plastic insert sleeve sized to allow not more than 6mm annular space between supported pipe and sleeve. Supports shall be affixed using appropriate mounting bolts, nuts and washers to 12 gauge rolled structural steel channel, 1- 5/8 inch by 1-5/8 inch minimum, or mounted to structurally sound surfaces suitable to accept mounting hardware.

.2 Non- Restrictive Clevis Hangers Pipe Supports

.1 Clevis type hangers shall be constructed of an exterior metal supporting bracket and an independent plastic insert sleeve sized to allow not more than 6mm annular space between supported pipe and sleeve. Only insert sleeves of the indicated size shall be used for the corresponding supported pipe. The supporting bracket shall be affixed to an independent clevis hanger bracket with means to be mounted using all thread rod with appropriate nuts and washers and sized per MSS-SP 58

.3 Non-Restrictive Vertical Pipe Supports

.1 Vertical supports shall be mounted similarly to horizontal support with the addition of 35 durometer cushion strips mounted to both sides of plastic insert sleeve.

3. EXECUTION

3.1 LOCATION

.1 Plastic pipes shall be supported at distances as recommended by manufacturer according to load, material, temperature, pipe wall thickness and diameter or as follows:

D (mm)	Bracket Spacing (mm)
20	650
25	700
32	850
40	950
50	1100
63	1200
75	1350

.2 Horizontal and vertical supports shall be provided within 300mm, on both sides, of any change in pipe direction.

3.2 INSTALLATION

.1 Pipe supports to be installed per manufacturer’s requirements.

.2 Following installation pipe shall be free to move due to horizontal expansion.

.3 Pipe clamps shall not exert a stress load on the pipe.

END OF SECTION

SECTION 40 05 23
PIPE - STAINLESS STEEL

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Stainless steel piping, fittings and appurtenances.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

.2 Division 01 - General Requirements.

.3 Section 40 05 00 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Society of Mechanical Engineers (ASME):

.1 B16.5, Pipe Flanges and Flanged Fittings.

.2 B31.1, Power Piping.

.3 B31.3, Process Piping.

.2 ASTM International (ASTM):

.1 A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

.2 A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 A312, Standard Specification for Seamless, Welded, and Heavy Cold Worked Austenitic Stainless Steel Pipes.

.4 A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.

.5 A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

.6 A530, Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.

.7 A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

.8 A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 See Specification Section 40 05 00.

.3 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.4 Fabrication details and welding procedure specifications for all work to be done under this Specification Section.

.5 Factory test reports.

.6 Welders qualifications and certificates.

.7 Welding test results.

.8 If mechanical grooved type coupling system is used, submit piping, fittings, and appurtenant items which will be utilized.

2. PRODUCTS

2.1 MATERIALS

.1 Tubing:

.1 ASTM A269.

.2 Filler material: Extra low carbon (ELC) with 0.03 percent maximum carbon.

.2 Pipe, unless noted otherwise on individual piping system in Specification Section 40 05 00:

.1 ASTM A778.

.2 ASTM A312.

.3 Pipe Fittings:

.1 ASTM A774.

.4 Flanges, unless noted otherwise on individual piping system in Specification Section 40 05 00:

.1 Flat faced.

.2 Welding neck or slip on type.

.3 ASTM A182, Type 316L.

.5 Nuts, Bolts and Washers, unless noted otherwise on individual piping system in Specification Section 40 05 00:

.1 ASTM A320, Type 316.

.2 Two (2) nuts provided for 25mm (1 in) DIA bolt applications and larger.

.3 Washers to be used on both sides of bolted connections.

.6 Gasket Material, unless noted otherwise on individual piping system in Specification Section 40 05 00:

.1 Rubber or neoprene.

.2 Temperature rating of 100 DEGC.

.3 NSF/ANSI 61 listed.

.7 Flexible Metal Hose:

.1 General: Braided stainless steel flexible hose.

.2 Connections: Provide ANSI 125 flanged connections.

.3 Length: Minimum 12 IN or as noted on the Drawings.

.4 Pressure: Working pressure of hose equal or greater than test pressure of connecting piping.

2.2 FABRICATION

.1 Piping shall be fabricated to ASME B31.3, Normal Fluid Service. Weld testing and pressure testing to be per ASME B31.3, Normal Fluid Service. Weld testing to include radiographic weld testing as per ASME B31.3.

.2 All stainless steel piping, fitting products shall be pickled/passivated to remove free iron contamination suffered during the fabrication. Pickling/passivation shall be per the requirements of ASTM A380 following the conclusion of fabrication operations, just prior to shipping.

.1 Assemblies passivated following fabrication shall be protected from additional carbon steel surface contamination during all subsequent packing, shipping, handling, and installation operations as described in ASTM A380.

.2 Solvents and acid cleaning solutions shall be controlled and disposed of by the fabricator according to all applicable federal, state, and local pollution control regulations.

.3 Diameter tolerance and wall thickness tolerance are to conform to ASTM A530.

.4 Joints:

.1 Shop welded circumferential buttweld joints.

.2 ASME B16.3, Class 150.

3. EXECUTION

3.1 EXAMINATION

.1 Prior to installation, inspect and verify condition of piping and appurtenances.

.1 Installation constitutes installer's acceptance of condition for satisfactory installation.

3.2 PREPARATION

.1 Correct defects or conditions which may interfere with or prevent a satisfactory installation.

.2 Ensure ends of pipe to be fitted with flanges have all protrusions ground flush.

3.3 INSTALLATION

.1 Ensure all pipe cutting, threading and jointing conforms to requirements of ASME B31.3.

.1 Lubricate all pipe threads with Teflon tape.

.2 Welding:

.1 Provide caps, tees, elbows, reducers, etc., manufactured for welded applications. Elbows are to be long radius. Threadolets are to be used for threaded branch connections.

.2 Provide welds sound and free from embedded scale or slag, and tensile strength at weld not less than pipe.

.3 Perform butt welds only with an inert gas shielded process.

.4 Adequate inert gas protection is to be provided to the top and under or backside of the weld to protect from atmospheric contamination.

.5 Filler metal is to be applied to all manually-performed welds appropriate for the base material being welded.

.6 Only inert gas shielded welding processes are to be used for spool fabrication.

.7 Provide butt welds with 100 PCT penetration to the interior or back side of the weld joint.

.8 Weld reinforcement on both sides of the weld are to be smooth, uniform and no more than 1.5mm (1/16 in) in height.

.3 Joining Method - Flanges:

.1 Leave 1.5mm to 9.5mm (1/8 in to 3/8 in) flange bolts projecting beyond face of nut after tightening.

.2 Coordinate dimensions and drillings of flanges with flanges for valves, equipment, and other systems.

.3 When bolting flange joints, exercise extreme care to assure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or cause unnecessary stress, bending or torsional strains being applied to cast flanges or flanged fittings.

.1 Allow one flange free movement in any direction while bolts are being tightened.

.4 Do not assemble adjoining flexible coupled, mechanical coupled or welded joints until flanged joints in piping system have been tightened.

.5 Gradually tighten flange bolts uniformly to permit even gasket compression.

.6 Do not overstress bolts to compensate for poor installation.

.7 Tighten bolts evenly around pipe until following range of torques is achieved:

BOLT SIZE, IN	RANGES OF TORQUE, NM (FT/LBS)
5/8	55 – 80 (40 – 60)
3/4	80 – 125 (60 – 90)
1	90 – 135 (70 – 100)
1-1/4	70 – 160 (90 – 120)

3.4 FIELD QUALITY CONTROL

.1 Test piping systems in accordance with Specification Section 40 05 00.

3.5 CLEANING

.1 Clean in accordance with Specification Section 40 05 00.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Plastic pipe.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

.2 Division 01 - General Requirements.

.3 Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 See Specification Section 40 05 00.

.2 Referenced Standards:

.1 ASTM International (ASTM):

.1 PVC (polyvinyl chloride) materials:

.1 D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

.2 D1785, Standard Specification for Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.

.3 D2467, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

.4 D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

.5 D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.6 D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

.7 D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

.8 F439, Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.9 F441, Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.10 F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

.11 F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

.12 F949, Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.

.2 Installation:

.1 D2321, Standard Practice for Underground Installation of Thermosplastic Pipe for Sewers and Other Gravity-Flow Applications.

.2 American Water Works Association (AWWA):

.1 PVC (polyvinyl chloride) materials:

.1 C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN Through 12 IN, for Water Distribution.

.2 C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.

.3 C907, Standard for Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water, Wastewater, & Reclaimed Water Services

.2 Polyethylene (PE) materials:

.1 C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 IN through 3 IN, for Water Service.

.3 Canadian Standards Association (CSA)

.1 PVC

.1 B137.2, Standard for Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications.

.2 B137.3, Standard for Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications.

.2 CPVC

.1 B137.6, Standard for Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems.

.4 NSF International (NSF).

1.3 SUBMITTALS

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 See Specification Section 40 05 00.

2. PRODUCTS

2.1 PVC PIPING (EXPOSED)

.1 General:

.1 Provide Schedule 80 pipe with Schedule 80 fittings and appurtenances to locations shown on Drawings.

.2 Furnish materials in full compliance to following material specifications:

.1 Manufacture pipe, fittings and appurtenances from polyvinyl chloride (PVC) compound which meets the requirements of Type 1, Grade 1 (12454-B) Polyvinyl Chloride as outlined in ASTM D1784.

.2 Manufacture pipe, fittings and valves from materials that have been tested and approved for conveying potable water by the NSF.

.2 Pipe:

.1 Furnish pipe meeting requirements of ASTM D1785.

.2 Pipe 50 mm and less to be solvent welded.

.3 Pipe larger than 50mm may be either flanged or solvent welded unless shown otherwise on Drawings.

.3 Fittings: Provide ASTM D2467 PVC socket type fittings having the same pressure and temperature rating as the pipe.

.4 Flanges/Unions:

.1 Furnish flanges and unions at locations shown on Drawings.

.2 Provide either flanges or unions at valves, penetrations through structures and equipment connections.

.3 For pipe larger than 50 mm, provide 150 LB socket type PVC flange.

.4 For pipe 50 mm and less, provide socket type PVC union with Buna O-rings.

.5 Use flat, full faced natural rubber gaskets at flanged connections.

.1 Furnish heavy hex head bolts, each with one heavy hex nut, ASTM F593 Type 316 stainless steel.

.6 Use spacers supplied by pipe manufacturer when mating raised-faced flanges to other flanges.

.5 Installation:

.1 Field threading PVC will not be permitted.

.1 Perform required threaded connections or attachments by the use of factory molded socket by threaded adapters.

.2 Female adapters are not acceptable.

.2 Employ installation and pipe support practices and solvent welding all in compliance to the manufacturer's printed recommendation.

.1 Continuously support PVC piping at liquid operating temperatures in excess of 40 DEGC.

.2 For vertical piping, band the pipe at intervals to rigidly support load of twice vertical load.

.3 Support riser clamps on spring hangers.

.4 Do not clamp PVC tightly or restrict movement for expansion and contraction.

.3 Socket welded connections to be tested to ASME B31.3.

2.2 PVC TUBING

.1 General: Provide nylon tubing with fittings and appurtenances as shown on Drawings.

.2 Materials:

.1 Furnish clear outer braided tubing with braid outside the walls.

.2 Have tubing manufactured of nylon with working temperatures from -15 to 82 DEGC.

.3 Design tubing with a minimum safety factor of 4 to 1 ratio of burst pressure to working pressure at maximum temperature.

.4 Provide tubing with working pressure of 517 kPa at 82 DEGC.

.5 Ensure that tubing is self-extinguishing and fire resistant.

.3 Fittings:

.1 Install tubing with nylon fittings and connectors.

.2 Use barbed type adapters with stainless steel clamps.

.3 Ensure fittings have the same pressure and temperature rating as the tubing.

3. EXECUTION

3.1 IDENTIFICATION

.1 Identify each length of pipe clearly at intervals of 1.5 m or less.

.1 Include manufacturer's name and trademark.

.2 Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications and NSF approvals when applicable.

3.2 PRESSURE PIPING

.1 Installation:

.1 Field threading of PVC pipe will not be permitted.

.2 Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

END OF SECTION

SECTION 40 05 33

PIPE – Ethylene Chlorotrifluoroethylene

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 All ethylene chlorotrifluoroethylene (ECTFE) piping and fittings as indicated in the Contract Documents.

.2 ECTFE piping systems shown and/or scheduled on the Drawings.

.2 Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 ASTM International (ASTM):

.1 D 638, Standard Test Method for Tensile Properties of Plastics.

.2 D 1559, Test Method for Resistance of Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

.3 D 1598, Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

.4 D1599, Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings.

.5 D1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.6 D 2122, Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

.7 D 2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

.8 D 2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

.9 D 3222, Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.

.10 D4101, Standard Specification for Polypropylene Injection and Extrusion Materials.

.2 International Organization for Standardization (ISO)

.1 10931, Plastics Piping Systems for Industrial Applications - Poly(vinylidene fluoride) (PVDF) — Specifications for Components and the System.

1.3 SUBMITTALS

.1 Shop drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 See Specification Section 40 05 00.

.3 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.4 Product data for the system specified, relative to materials, dimensions of individual components, profiles and finishes.

.5 Product certificates signed by manufacturer of ECTFE piping product stating compliance to stated requirements.

.6 Welder certificates, certifying that welders comply with the installation procedures as outlined by the chosen piping manufacturers' welding system:

.1 Chemline Plastics Ltd.'s Fusion Procedure Specification CL100 which bears TSSA approval number "ACCEPT 920R1" in accordance with ASME B31.1 and B31.3. All required training should be scheduled and completed at job startup.

.2 GF Piping Systems Welding Guidelines.

.7 All welding training to be completed prior to job start-up.

.8 All welding fusion machines to be provided by the chosen piping system manufacturer.

.9 Qualification of firms supplying ECTFE. Firms must have a minimum of five years experience in design, installation and operation of thermoplastic high-purity piping systems.

.2 Certificates:

.1 Provide Owner with a written statement that manufacturer's equipment has been installed properly, tested, and is ready for operation by Owner's personnel for all polypropylene piping systems.

.3 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Chemline Plastics Ltd.

.2 G.F. Plastic Piping Systems.

.2 Piping and valves shall all be supplied by a single manufacturer.

2.2 MATERIALS

.1 ECTFE pipe and fittings shall be manufactured from unpigmented and opaque Ethylene chlorotrifluoroethylene resin material. Pipes and fittings designed for industrial applications shall provide 25 years of operational lifetime with water at 20°C.

.2 Provide and install polypropylene pipe as scheduled or indicated on Drawings to standards dimensions ratio (SDR), as outlined in ASTM D1785 measured in accordance with ASTM D2122.

.3 Provide polyvinylidene fluoride pipe having a minimum pressure rating as follows:

.1 ½" to 2-½" pipe: 1600 kPa (232 psi).

.2 3" TO 12" pipe: 1034 kPa (150 psi).

2.3 FABRICATION

.1 Materials:

.1 All piping and fittings are to be produced based on an SDR system and calculated utilizing a Hydrostatic Design Basis according to ASTM D 2837.

.2 Provide butt-fusion joints for connections.

.3 Provide flanged connections where shown on drawings.

.2 Valves:

.1 Ball Valves:

.1 Shall be full port, with true union ends, and be constructed of PVC with EPDM seals. Shall come with ECTFE butt-fusion or flanged end connectors as shown on drawings.

.2 Shall be rated for 230 psi (16 bar) when measured at 68°F (20°C).

.3 Where required, electric valve actuators shall be supplied by the valve manufacturer to ensure proper system operation.

.4 Basis of design: Chemline Type 21.

.5 Approved alternate: Georg Fischer.

.2 Check Valves:

.1 Shall be ball check type and be constructed of PVC with EPDM o-rings. Shall come with ECTFE butt-fusion or flanged end connectors as shown on drawings.

.2 Valve shall be able to be installed in vertical or horizontal orientation.

.3 Shall be rated for 232 psi (16 bar) when measured at 68°F (20°C).

.4 Basis of design: Chemline Type ES Series.

.5 Approved alternate: Georg Fischer.

.3 Butterfly Valves:

.1 Shall be constructed of Polypropylene with PVC disk with EPDM seats and o-rings.

.2 The valve shall be installed in a horizontal position.

.3 Shall be rated at 150PSI at 0-50C

.4 Basis of design: Chemline Type 58

.5 Approved alternate: Georg Fischer.

3. EXECUTION

3.1 INSTALLATION

.1 Installation:

.1 All welded joints to be butt welded using infrared welding technique.

.2 Installers shall be pre-qualified through training on welding technique according to ASTM D-2657. Installer to provide certification card verifying that they have met the requirements of the manufacturer with regards to knowledge of proper product installation and testing methods

.3 Installer shall ensure that all pipe and fittings used are components of the same system. No mixing of various manufacturers' pipe and/or fittings shall be allowed.

.4 System components shall be installed using butt fusion or socket fusion joining methods according to manufacturer's instructions. Fusion units to be provided by piping manufacturer.

.5 All union valves are to have their end connectors replaced with ECTFE butt-fusion or flanged ends as shown on drawings.

.6 Piping shall be completed per drawing layouts with all pipe and valve supports in place.

.7 Pipe, valves and equipment shall be supported as specified, without any concentrated loads on the system.

.8 Pipe shall be in good condition, void of any cracks, gouges or deformation.

.9 Pipe flanges shall be properly aligned. All flange bolts should be checked for correct torque.

.1 All joints should be reviewed for appropriate welding technique.

.2 Socket to have two beads on the end of the fitting and on the outside of the pipe in contact. Joints should have two beads 360° around the joint.

.2 Inspection:

.1 Pipe manufacturer shall inspect installation prior to operation.

.3 Testing:

.1 Piping systems shall be pressure tested prior to being put into operational service. Test fluid should be deionized water. Testing must be done hydrostatically. Air is not acceptable.

.2 Filling the system: Open all valves and vents to purge the system of air. Slowly inject the water into the system, making sure that air does not become trapped in the system.

.3 Begin pressurizing the system in increments of 10 PSI. Bring the system up to 100 PSI and hold. Allow the system to hold pressure for a minimum of 12 hours. Check pressure gauge after one hour. Due to natural creep effects on plastic piping the pressure will have decreased. If drop is less than 10% pump the pressure back up. At this time the system may be fully pressurized to desired test pressure.

.4 If after one hour the pressure has decreased more than 10%, consider the test a failure. Note the 10% value may need to be greater for larger systems, or systems experiencing significant thermal changes.

.5 Test is to be witnessed by Engineer and certified by the contractor.

.4 Hanging

.1 Pipe shall be hung in accordance with manufacturers' recommendations to avoid damage to the pipe. Proper support spacing is required in order to avoid sagging of the material. Support spacing is temperature dependent and shall be based on manufacturer recommendations.

END OF SECTION

SECTION 40 05 51
VALVES - BASIC REQUIREMENTS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Valving, actuators, and valving appurtenances.

.2 Related Sections include but are not necessarily limited to:

.1 Division 00 - Procurement and Contracting Requirements.

.2 Division 01 - General Requirements.

.3 Section 01 61 03 - Equipment - Basic Requirements.

.4 Section 09 96 00 - High Performance Industrial Coatings.

.5 Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

.6 Section 40 05 52 - Miscellaneous Valves.

.7 Section 40 05 63 - Ball Valves.

.8 Section 40 05 64 - Butterfly Valves.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Society of Mechanical Engineers (ASME):

.1 B1.20.1, Pipe Threads, General Purpose.

.2 B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

.3 B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International (ASTM):

.1 A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.2 D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

.3 D638, Standard Test Method for Tensile Properties of Plastics.

.4 D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

.5 D695, Standard Test Method for Compressive Properties of Rigid Plastics.

.6 D2240, Standard Test Method for Rubber Property-Durometer Hardness.

.3 American Water Works Association (AWWA):

.1 C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.

.2 C210, Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

.3 C213, Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

.4 C500, Standard for Metal-Seated Gate Valves for Water Supply Service.

.5 C504, Standard for Rubber-Seated Butterfly Valves.

.6 C507, Standard for Ball Valves, 6 IN through 48 IN (150 MM through 1200 MM).

.7 C550, Standard for Protective Coatings for Valves and Hydrants.

.8 C606, Standard for Grooved and Shouldered Joints.

.4 American Water Works Association/American National Standards Institute (AWWA/ANSI):

.1 C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.5 National Electrical Manufacturers Association (NEMA):

.1 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 MG 1, Motors and Generators.

.6 Canadian Electrical Code

1.3 DEFINITIONS

.1 The following are definitions of abbreviations used in this Specification Section or one of the individual valve sections:

.1 CWP: Cold water working pressure.

.2 SWP: Steam working pressure.

.3 WOG: Water, oil, gas working pressure.

.4 WWP: Water working pressure.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 See Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.3 Valve pressure and temperature rating.

.4 Valve material of construction.

.5 Special linings.

.6 Valve dimensions and weight.

.7 Valve flow coefficient.

.8 Wiring and control diagrams for electric actuators.

.3 Test reports.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

.3 Informational Submittals:

.1 Verification from valve actuator manufacturer that actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted, and that the valve actuator responds correctly to the valve position command.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

2.2 MATERIALS

.1 Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

.1 Valve Actuators - General:

.1 Provide actuators as shown on Drawings or specified.

.2 Counter clockwise opening as viewed from the top.

.3 Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.

.4 Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 FT-pounds torque on the operating nut.

.5 Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.

.6 Extension stem:

.1 Install where shown or specified.

.2 Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.

.3 Pin all stem connections.

.4 Center in valve box or grating opening band with guide bushing.

.2 Exposed Valve Manual Actuators:

.1 Provide for all exposed valves not having electric or cylinder actuators.

.2 Provide handwheels for gate and globe valves.

.1 Size handwheels for valves in accordance with AWWA C500.

.3 Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.

.1 Lever actuators for butterfly valves shall have a minimum of five intermediate lock positions between full open and full close.

.2 Provide at least two levers for each type and size of valve furnished.

.4 Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger.

.5 Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.

.6 Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.

.7 Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.

.1 Cadmium-plated chain looped to within 3 FT of finish floor.

.2 Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.

.3 For smaller valves with lever or handle operators, provide offset tee handles with attached chain for operation from the operating floor.

.8 Provide cast iron floor stands where shown on Drawings.

.1 Stands to be furnished by valve manufacturer with actuator.

.2 Stands or actuator to include thrust bearings for valve operation and weight of accessories.

.3 Electric Actuators (208 V, 3 PH):

.1 Tag numbers:

.1 MV-001A

.2 MV-005A

.3 MV-007E

.4 MV-008G

.5 MV-038G

.2 General Requirements:

.1 Provide electric valve actuators with integral control devices and a remote pushbutton station.

.2 The actuators shall be intelligent, non-intrusive type, suitable for use on a nominal 120 volt and 1 phase power supply and are to incorporate motor, integral reversing starter, local control facilities and terminals for remote control and indication connections housed within a self-contained, sealed enclosure.

.3 Setting of the torque levels, position limits and configuration of the indication contacts, etc. shall be carried out using a programming tool without the removal of any actuator covers over an Infrared or Bluetooth wireless interface or through the use of local control knobs, push buttons, etc.

.1 Provision shall be made to disable Bluetooth communications or only allow a Bluetooth connection initiated by an Infrared command for maximum security.

.2 The programming tool shall enable the user to extract and store actuator configuration and data logger files within the tool.

.3 The programming tool shall store up multiple configuration and data logger files. Stored configuration and data logger files shall also be able to be uploaded to both the actuators and to diagnostic software provided by the actuator manufacturer.

.4 Conform to AWWA C542.

.5 Suitable for full 90-degree rotation of quarter-turn valves or for use on multi-turn valves.

.6 Torque:

.1 Size to 1-1/2 times the required operating torque.

.2 Motor stall torque shall not exceed torque capacity of valve.

.7 Furnish electric actuator integral with valve consisting of:

.1 Motor.

.2 Gearing.

.3 Handwheel.

.4 Limit and torque switches.

.5 Lubricants.

.6 Heating elements.

.7 Wiring.

.8 Terminals for motor power and controls.

.9 Drive nut.

.8 Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by the Canadian Electrical Code.

.3 Housing/enclosure:

.1 Provide cast iron gear housing and cast iron load bearing enclosure.

.2 Non load bearing enclosure and housing: Aluminum or cast iron.

.3 Rated for area classification shown on Drawings.

.4 Provide O-ring seals for covers and entries.

.5 Terminal and limit switch compartment covers are to be fastened to gear housing by stainless steel fasteners with capture device to prevent loss.

.4 Motors:

.1 The motor shall be an integral part of the actuator, designed specifically for valve actuator applications.

.2 The motor design shall be a low inertia high torque.

.3 Motor protection shall be done via two thermostats or three thermo-switches embedded in the motor end windings.

.4 The motor shall be de-energized within 8 seconds in the event of a stall when attempting to unseat a jammed valve or gate.

.5 Lost phase protection.

.6 For ON/OFF duty, Class F insulated with a time rating of at least 15 minutes at 104 DegF (40 DegC) or twice the valve stroking time, whichever is longer, at an average load of at least 33 percent of maximum value torque.

.7 For MODULATING duty, the electric motor shall be suitable for up to 1200 starts per hour with a duty in accordance with ICE 34-1 to S4 50 percent shall include a solid state starter. Removal of the motor should be possible without draining the lubricant from the actuator.

.8 Provide motors that are totally enclosed, high torque design made expressly for valve actuator service and capable of operating the valve under full differential pressure for complete open-close and reverse cycle of travel at least twice in immediate succession without overheating.

.9 Design motors in accordance with NEMA MG 1 standards, with Class B insulation, and to operate successfully at any voltage within 10 percent above or below rated voltage.

.10 Provide positive method to ensure motor bearings are permanently lubricated.

.11 Motor housing:

.1 Aluminum or cast iron.

.2 Totally enclosed non-ventilated.

.3 Enclosure:

.1 Actuators shall be double O-ring sealed, watertight to IP66/IP68 at a minimum of 26 FT for 96 hours, NEMA 4, 6. Removal of the terminal cover shall not change the actuator NEMA ratings. Actuator must be able to operate at least ten times during submersion. Breathers, heaters, and drains shall not be permitted. External conduit connections from motor to actuator controller shall not be permitted.

.2 NEMA 7 explosion proof actuator enclosure ratings shall be provided if shown on the drawings and/or required by the site conditions.

.3 Temporary site storage without the need for electrical supply connection at an ambient of 22 DegF to 158 DegF.

.12 Provide motor capable of operating in any position.

.13 Provide motor sealed from gearcase to allow any mounting position.

.14 Provide motors suitable for 120 V, 1 phase, 60 Hz.

.15 Reversing motor starter with built-in overload protection.

.16 Starters shall provide electrical overload protection of the motor by sensing high current draw or high motor winding temperature. Overloads shall be the automatic reset type.

.5 Gearing:

.1 The actuator gearing shall be totally enclosed in an oil-filled or grease-filled gearcase suitable for operation at any orientation. Thrust bearings shall be at the base of the actuator to eliminate gearcase stress. This shall also permit the removal of the actuator, without the removal of the thrust base from the valve or gate. The design should be such as to permit the opening of the gearcase for inspection or disassembled without releasing the stem thrust or taking the valve or gate out of service. Thrust bearing shall be sealed for life and the base shall be capable of withstanding five times the rated thrust of the actuator.

.2 Provide power gearing consisting of heat treated steel helical gears, carburized and hardened alloy steel worm, and alloy bronze worm gear, all grease or oil bath lubricated, designed for 100 percent overload, and effectively sealed against entrance of foreign matter.

.3 Provide gearing mechanism constructed to permit field changes of reduction gear ratio.

.4 Design actuators so that motor comes up to speed before stem load is encountered in either opening or closing operation.

.5 Limit switch gearings and feedback device reduction gearing:

.1 Steel or bronze.

.6 Support rotating shafts with anti-friction bearings.

.7 Provide separate drive nut/thrust bearing assembly:

.1 The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. Normally the drive bush shall be positioned in a detachable base of the actuator. Thrust bearings, when housed in a separate thrust base, should be of the sealed-for-life type.

.2 Mounted to base of actuator.

.3 High tensile bronze.

.4 Quarter turn actuator: Worm gearboxes where required, shall be supplied with full 360 degree bronze or ductile iron worm wheels and end-of travel mechanical stops. Designs with segmented worm gears shall not be permitted.

.5 Provide grease fitting on drive assembly.

.6 Handwheel:

.1 A handwheel shall be provided for emergency operation. Motor drive shall be restored automatically by starting the motor. The hand auto level shall be padlockable in both hand and automatic positions. The clockwise rotation of the handwheel shall provide a clockwise rotation of the drive output. It should be possible to select hand operation while the actuator handwheel drive must be mechanically independent of the motor drive.

.2 The handwheel drive must be mechanically independent of the motor drive, and any gearing should be such as to permit emergency manual operation in a reasonable time. Clockwise operation of the handwheel shall give closing movement of the valve unless otherwise stated in the job specification.

.3 Permanently attached for manual operation.

.4 Positive declutch mechanism to engage and disengage handwheel.

.5 Handwheel shall not rotate during motor operation.

.6 Inoperable motor shall not prevent manual operation.

.7 Torque monitoring:

.1 Torque and turns limitation shall be adjustable without removing any actuator covers via Bluetooth connectivity.

.2 Torque sensing shall be from direct measurement of force at the output of the actuator, governed by a solid-state torque sensor that directly measures the output torque of the actuator to protect the valve and actuator from damage and possible obstructions. Methods of determining torque using either mechanical torque switches or data derived from the motor such as motor speed, current, flux, etc. are not acceptable.

.3 The actuator shall be equipped with torque sensing responsive to overloads encountered in either the opening or closing direction.

.4 Torque monitoring shall be electronically sensed and shall not rely on mechanical torque switches.

.5 Torque sensing switches shall be independently adjustable for both the opening and closing directions.

.6 The torque protection feature shall operate during the complete valve cycle.

.7 The torque switch shall be configured to disengage the actuator motor in the event excessive loads are encountered during travel and/or for torque seating of valves as recommended by the manufacturer.

.8 Limit Switches:

.1 Each valve actuator shall have a minimum of two transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.

.2 Position measurement shall be contactless with no more than five moving parts and be single fault tolerant. Technologies such as LEDs or potentiometers for position measurement are considered unreliable and therefore are not acceptable. Position setting range shall be 2.5 to 8000 turns, with resolution to 7.5° of actuator output. Position setting range shall be via a solid-state absolute position encoder that eliminates the use of counting gear trains or potentiometers.

.3 Position monitoring shall be electronically sensed and shall not rely on mechanical limit switches.

.4 Contacts shall be configurable through the actuator microprocessor controller to allow flexibility of adjustment.

.5 Housed in actuator enclosure.

.9 Open-close actuator controls:

.1 The actuator shall incorporate local controls. It shall be possible to select maintained or non-maintained local control. The local controls and display shall be rotatable through increments of 90 degrees to suit valve.

.2 Provide control assembly with necessary holding relays, reversing starter, control transformers of sufficient capacity to provide control power, space heating element power and valve position transmitter.

.3 Provide control assembly in an enclosure rated for the defined area classification.

.4 Controls for open/close actuator:

.1 Local operator controls of the valve shall be integral to the valve actuator, unless otherwise shown.

.2 Provide the following operator controls and interface devices:

.1 Open/Stop/Close control knob or pushbutton.

.2 Remote/local control knob or pushbutton.

.3 Full open light – Configurable LEDs: green, red and yellow.

.4 Full close light – Configurable LEDs: green, red and yellow.

.5 Digital display for valve percent open indication.

.6 Open and close relays as required.

.3 Provide control enclosure to accept:

.1 Remote open/close switches.

.4 Provide dry, relay contacts in control enclosure for interface to the Plant Control System:

.1 REMOTE contact.

.2 Full OPEN contact.

.3 Full CLOSE contact.

.4 FAULT contact.

.5 Wire all components to an internal terminal strip and include mounted wiring diagram inside enclosure.

.6 Four separate contacts shall be provided which can be selected to indicate any position of the valve. Provision shall be made for the selection of a normally closed or open contact form. Contacts shall operate when all external power to the actuator is isolated.

.1 The contacts shall be rated for 5mA to 5A, 120V AC, 30V DC.

.2 Contacts shall be programmable to signal 40 actuator status conditions at a minimum, including at least the following data:

.1 Control:

.1 Open/Stop/Close

.2 Status:

.1 Motor Running Open Direction

.2 Motor Running Closed Direction

.3 Fully Open
.4 Fully Closed
.5 Percentage Open
.6 Percentage Torque
.7 Namur conditions
.8 ESD Active
.9 Remove/Local selected

.3 Alarms:
.1 Communications Failure
.2 Actuator Alarm
.3 Valve Alarm
.4 Battery Low Alarm
.5 Scheduled maintenance due
.6 Lost phase
.7 Torque trip

.10 Local Position Indication
.1 The actuator display shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully close in 0.1 percent increments.
.2 Blinking yellow LED indicator shall be used to show the following conditions:
.1 Actuator service interval exceeded.
.2 Actuator fault.
.3 Actuator output torque within 10 percent of torque setting.
.3 Mechanical Dial Position Indicator (MDPI) shall be supplied.
.4 The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display information. The text display shall be selectable between English and other languages.

.11 Manufacturers:
.1 RoTork IQ/IQT.

.4 Electric Actuators (120 V, 1 PH) for PVC, CPVC or PVDF Ball Valves:
.1 Tag numbers and approved manufacturer:
.1 MV-030D – Chemline ERF Series.
.2 MV-031D – Chemline ERF Series.
.3 MV-038B – Spears
.4 Approved equal.
.2 Electric actuator shall be same manufacturer as connected valve.

.3 CSA Approved 1/4" turn reversible rotary actuator with embedded thermal overload protection switch.

.4 All electric actuators shall have a 2-piece NEMA 4X/IP66 Polyamide PA6 cover and fiberglass-reinforced Polyamide PA6 base, stainless steel fasteners.

.5 All electric actuators shall have PC board control and built-in on-board 4-watt heater/thermostat.

.6 All electric actuators shall consist of a reversible type electric motor with irreversible epicyclic gears to eliminate gear backlash or valve drift or stand gears.

.7 All electric actuators shall have a permanently-attached manual override and visual position indicator.

.8 All electric actuators shall have a visual mechanical indication, showing output shaft and valve position.

.9 All electric actuators shall be minimum 50% duty cycle for high cycling applications.

.10 All electric actuators shall have voltage options of 120/240 VAC (60 Hz), and 12/24 VDC or 24 VAC (60 Hz).

.11 All electric actuators shall have two fully adjustable, cam-actuated, end-of-travel limit switches of the snap-acting, double-throw type rated to 250 VAC and listed to carry a power load equal to or greater than the locked rotor current of the actuator.

.12 All electric actuators shall have torque outputs from 180 in.-lbs.

.13 All electric actuators shall have a permanently lubricated gear train.

.14 All electric actuators shall have an ISO mounting bolt circle.

.15 All electric actuators shall be custom tagged with manufacturers' inspection number(s) to provide traceability

.5 Fabrication:

.1 End Connections:

.1 Provide the type of end connections for valves as required in the Piping Schedules presented in Section 40 05 00 or as shown on the Drawings.

.2 Comply with the following standards:

.1 Threaded: ASME B1.20.1.

.2 Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.

.3 Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.

.4 Soldered: ASME B16.18.

.5 Grooved: Rigid joints per Table 5 of AWWA C606.

.2 Refer to individual valve Specification Sections for specifications of each type of valve used on Project.

.3 Nuts, Bolts, and Washers:

.1 Wetted or internal to be bronze or stainless steel.

.1 Exposed to be zinc or cadmium plated.

.4 On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

.5 Epoxy Interior Coating: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

3. EXECUTION

3.1 INSTALLATION

.1 Install products in accordance with manufacturer's instructions.

.2 Painting Requirements: Comply with Section 09 96 00 for High Performance Industrial Coatings.

.3 Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

.4 For grooved coupling valves, install rigid type couplings or provide separate support to prevent rotation of valve from installed position.

.5 Install electric or cylinder actuators above or horizontally adjacent to valve and gear box to optimize access to controls and external handwheel.

.6 For threaded valves, provide union on one side within 2 FT of valve to allow valve removal.

.7 Install valves accessible for operation, inspection, and maintenance.

3.2 ADJUSTMENT

.1 Adjust valves, actuators and appurtenant equipment to comply with Section 01 75 00.

.1 Operate valve, open and close at system pressures.

.2 For all 120 VAC and 480 VAC electric actuators, employ and pay for services of valve actuator manufacturer's field service representative to:

.1 Inspect valve actuators covered by this Specification Section.

.2 Supervise adjustments and installation checks:

.1 Open and close valves electrically under local manual and demonstrate that all limit switches are properly adjusted and that switch contacts are functioning properly by verifying the inputs are received at the remote input/output (RIO) panels or local control panel as appropriate.

.2 Position modulating valves electrically under local manual control and demonstrate that the valve position feedback potentiometer is properly adjusted and that the feedback signal is received at the RIO panels or local control panel as appropriate.

.3 Simulate a valve position command signal at the RIO panel or local control panel as appropriate and demonstrate that the valve is controlled to the desired position without excessive hunting.

.3 Provide Owner with a written statement that the valve actuator manufacturer has verified that the actuators have been installed properly, that all limit switches and position potentiometers have been properly adjusted and that the valve actuator responds correctly to the valve position command.

3.3 SCHEDULES

.1 The following schedule is for actuated valves. See Drawings for manual valves.

Equipment Number	Service	Size, mm	Voltage/Phase	Operation	Notes
MV-001A	PW	250	120/1	Open/Close	- High Performance Butterfly Valve, class 150 - Max differential pressure: 120 m
MV-005A	PW	200	120/1	Open/Close	- High Performance Butterfly Valve, Class 300 - Max differential pressure: 175 m
MV-007E	PW	200	120/1	Open/Close	- High Performance Butterfly Valve, Class 150 - Max differential pressure: 120 m
MV-008G	PW	50	120/1	Open/Close	- Stainless Steel Ball Valve, - Max differential pressure: 75 m
MV-030D	CS	50	120/1	Open/Close	- PVC True Union Ball Valve, Motorized Operator by Valve Supplier - Max differential pressure: nil.
MV-031D	CS	50	120/1	Open/Close	- PVC True Union Ball Valve, Motorized Operator by Valve Supplier - Max differential pressure: nil.
MV-038B	OF	100	120/1	Open/Close	- PVC True Union Ball Valve, (Spears 5022T1-040), Motorized Operator by Valve Supplier - Max differential pressure: nil. - See drawing C-012.

END OF SECTION

SECTION 40 05 52
MISCELLANEOUS VALVES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Air release valves and Combination air valves.
- .2 Automatic control valves:
  - .1 Hydraulic rate of flow control and pressure reducing valve.
  - .2 Pressure relief valves
  - .3 Pressure relief valve inspection and repair.
- .3 Pressure-reducing valves (2 IN and smaller).
- .4 Pressure relief valves (1 IN and smaller).
- .5 Solenoid valves.

.2 Related Specification Sections include but are not necessarily limited to:
- .1 Division 00 - Procurement and Contracting Requirements.
- .2 Division 01 - General Requirements.
- .3 Section 01 61 03 - Equipment - Basic Requirements.
- .4 Section 09 96 00 – High Performance Industrial Coatings
- .5 Section 40 05 51 - Valves - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:
- .1 American Society of Mechanical Engineers (ASME):
  - .1 B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- .2 American Water Works Association (AWWA):
  - .1 C512, Standard for Air-Release, Air-Vacuum, and Combination Air Valves for Waterworks Service.
  - .2 C550, Standard for Protective Interior Coatings for Valves and Hydrants.
- .3 Canadian Standards Association (CSA).
- .4 Canadian Electrical Code (CEC).

1.3 SUBMITTALS

.1 Shop Drawings:
- .1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- .2 See Specification Section 40 05 51.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

.2 Submit request for substitution in accordance with Specification Section 01 25 003.

2.2 AIR RELEASE AND COMBINATION AIR VALVES

.1 General: Conform to AWWA C512.

.2 NSF/ANSI 61 certified.

.3 Air Release Valve:

.1 Acceptable manufacturers:

.1 Valmatic 22.9DISV

.2 Pratt WAR Series

.3 APCO Model 50.

.2 Materials:

.1 Body and cover: Ductile Iron.

.2 Float, linkage, trim and fasteners: Stainless steel.

.3 Seat: Buna-N or EPDM.

.3 Design requirements:

.1 Size: 25mm.

.2 Pressure rating: 2068 kPa (300 psi).

.3 Working Pressure: 1725 kPa (250 psi)

.4 Working maximum water flow: 75 L/s.

.5 NPT inlets and outlets equal to the nominal valve size.

.6 Provide stainless steel isolation ball valve, type as shown.

.7 Coating: NSF/ANSI 61 approved fusion bonded epoxy coated and lined to AWWA C550.

.4 Combination Air Release and Vacuum Valve:

.1 Acceptable manufacturers:

.1 Valmatic 202C.2DISV

.2 Pratt WCV Series

.3 APCO Series S-140

.2 Materials:

.1 Body and cover: Ductile Iron.

.2 Float, linkage, trim and fasteners: Stainless steel.

.3 Seat: Buna-N or EPDM.

.3 Design requirements:

.1 Single body type.

.2 Size: 50mm.

.3 Pressure rating: 2068 kPa (300 psi).

.4 Working Pressure: 1725 kPa (250 psi)

.5 Working maximum water flow: 75 L/s.

.6 NPT inlets and outlets equal to the nominal valve size.

.7 Provide stainless steel isolation ball valve, type as shown.

.8 Coating: NSF/ANSI 61 approved fusion bonded epoxy coated and lined to AWWA C550.

2.3 AUTOMATIC CONTROL VALVES FOR WATER SERVICE

.1 Control: Valve is to be piloted with pressure reducing and rate-of-flow control on left side of valve and pressure reducing control on the right side of the valve.

.1 Acceptable manufacturers:

.1 Cla-Val.

.2 Singer.

.2 Design requirements:

.1 Basic valve to come with dedicated:

.1 Pressure reducing and rate-of-flow piloting on left side of valve when the valve is operating to fill a reservoir.

.2 Pressure reducing piloting on right side of valve when the valve is operating into a pressure system (reservoir offline).

.3 Each set of piloting is to be independent of the other, one system will be isolated while the other is in operation.

.2 Modulate basic valve to maintain:

.1 Piloting on the left side of valve: A uniform flowrate and downstream pressure as set on control pilots.

.2 Piloting on the right side of valve: A uniform downstream pressure as set on control pilots.

.3 Materials:

.1 Body and cover: Ductile iron, globe style with a full port seat and class 300 flanged ends conforming to ANSIB16.42.

.2 Main valve trim: Stainless steel.

.3 Seat insert: Stainless steel.

.4 Internal trim parts: Stainless steel.

.5 Disc: Buna-N or EPDM.

.6 Diaphragm: Nylon fabric bonded with synthetic rubber.

.7 Coating: NSF/ANSI 61 approved fusion bonded epoxy coated and lined to AWWA C550.

.8 Stem: come with an oxy-nitride coating.

.4 Assembles all control features and hardware on basic valve at factory.

.5 Include with valve control:

.1 Stainless steel isolating ball valves at each body and cover tapping.

.2 Piloting y-type strainer.

.3 Stainless steel orifice type pilot restrictor.

.4 Opening speed control.

.5 Stainless steel tubing and fittings.

.6 Pilot valves of cast bronze or stainless steel.

.7 Atop the valve shall be a stem actuated, EEMAC 4 enclosed, 120VAC rated, SPDT limit switch assembly consisting of a valve stem extension, sealing gland, actuation collar, limit switch and mounting stand. Assembly shall be as furnished by the valve manufacturer.

.8 Rate-of-flow valve control:

.1 Flow control pilot shall have a nominal pressure differential range of 20-80 kPa (3-12 psig).

.2 It shall sense flow rate by means of head loss across a stainless steel orifice plate mounted (5 diameters) downstream of the valve outlet.

.3 Orifice plate shall be sized to produce a differential head of approximately 55 kPa at design flowrate.

.9 Pressure reducing control:

.1 Piloting on the right side of the valve shall also be fitted with a surge pilot to facilitate valve closing.

.6 Use corrosion-resistant metal for all exposed portions of the control.

.3 Design conditions:

.1 Size: 150mm

.2 Flow range:

.1 Normal maximum: 75 L/s

.2 Normal minimum: 50 L/s.

.3 Operating pressure:

.1 Upstream: 1600 kPa.

.2 Downstream: 1200 kPa.

.4 Static upstream pressure:

.1 Upstream: 1750 kPa.

.4 ACCESSORIES

.1 Furnish any accessories required to provide completely operable valves.

.5 FABRICATION

.1 Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.

.2 Control: Pressure relief.

.1 Acceptable manufacturers:

.1 Cla-Val.

.2 Singer

.2 Design requirements:

.1 Modulate basic valve to open at a pressure as set on control pilots.

.2 Materials:

.1 Body and cover: Ductile iron, globe style with a full port seat and class 300 flanged ends conforming to ANSIB16.42.

.2 Main valve trim: Stainless steel.

.3 Seat insert: Stainless steel.

.4 Internal trim parts: Stainless steel.

.5 Disc: Buna-N or EPDM.

.6 Diaphragm: Nylon fabric bonded with synthetic rubber.

.7 Coating: NSF/ANSI 61 approved fusion bonded epoxy coated and lined to AWWA C550.

.8 Stem: come with an oxy-nitride coating.

.3 Assembles all control features and hardware on basic valve at factory.

.4 Include with valve control:

.1 Stainless steel isolating ball valves at each body and cover tapping.

.2 Piloting y-type strainer.

.3 Stainless steel orifice type pilot restrictor.

.4 Closing speed control.

.5 Stainless steel tubing and fittings.

.6 Pilot valves of cast bronze or stainless steel.

.7 Atop the valve shall be a stem actuated, EEMAC 4 enclosed, 120VAC rated, SPDT limit switch assembly consisting of a valve stem extension, sealing gland, actuation collar, limit switch and mounting stand. Assembly shall be as furnished by the valve manufacturer.

.5 Piloting arrangement:

.1 Piloting of valve is to on left side of valve.

.6 Use corrosion-resistant metal for all exposed portions of the control.

.3 Design conditions:

.1 Size: 100mm

.2 Operating pressure:
.1 Upstream: 1860 kPa.
.2 Downstream: atmospheric
.3 Flow range:
.1 Pumped flowrate:
.1 Normal maximum: 75 L/s
.2 Normal minimum: 50 L/s.

.4 ACCESSORIES
.1 Furnish any accessories required to provide completely operable valves.

.5 FABRICATION
.1 Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.

.3 Control: Pressure relief valve rebuild – W212 Pump Station.
.1 Acceptable manufacturers:
.1 Cla-Val.
.2 Singer

.2 Design requirements:
.1 The existing Cla-Val pressure relief valve shall be inspected and a condition report shall be provided to the Owner. The cost of any subsequent authorized valve repairs, including to the ANSI/NSF-61 internal lining and external coating, will be dealt with separately by the Owner, separate from the contract.
.2 The existing Cla-Val pressure relief valve operated to relieve pressure at approximately 250 psi. The new pilot shall allow the main valve to relieve pressure at 20-30 psi. Pressure setting to be configured during commissioning.
.3 The valve is to be refurbished with new piloting as described below.
.4 Modulate basic valve to open at a pressure as set on control pilots.
.5 Valve control:
.1 Stainless steel isolating ball valves at each body and cover tapping.
.2 Piloting y-type strainer.
.3 Stainless steel orifice type pilot restrictor.
.4 Closing speed control.
.5 Stainless steel tubing and fittings.
.6 Pilot valves of cast bronze or stainless steel.
.7 Atop the valve shall be a stem actuated, EEMAC 4 enclosed, 120VAC rated, SPDT limit switch assembly consisting of a valve stem extension, sealing gland, actuation collar, limit switch and mounting stand. Assembly shall be as furnished by the valve manufacturer.
.6 Use corrosion-resistant metal for all exposed portions of the control.

.3 Design conditions:
.1 Operating pressure:
.1 Upstream: 150 kPa.
.2 Downstream: atmospheric
.2 Flow range:
.1 Pumped flowrate:
.1 Normal maximum: 40 L/s
.2 Normal minimum: 30 L/s.
.4 ACCESSORIES
.1 Furnish any accessories required to provide completely operable valve.
.5 FABRICATION
.1 Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.

2.4 PRESSURE-REDUCING VALVES (2 IN AND SMALLER)

.1 Water Pressure Regulators:
.1 Acceptable manufacturers:
.1 Watts Series LF25AUB-Z3.
.2 Materials:
.1 Body: Bronze.
.2 Strainer body: Bronze.
.3 Strainer screen: Stainless steel.
.3 Design requirements:
.1 Self-contained diaphragm operated.
.1 Spring loaded.
.2 Field adjustable.
.2 Strainer: Y-type on supply.
.3 Size: 50mm.
.4 Pressures: 170 PSI inlet and 80 PSI outlet pressure.

2.5 SOLENOID VALVES (1 IN AND SMALLER)

.1 General Service (Air - Water):
.1 Acceptable manufacturer:
.1 ASCO.
.2 Materials:
.1 Body: Brass.
.2 Seat: Buna-N.
.3 Insulation: Class F.

.3 Design requirements:
  .1 120 VAC.
  .2 Two-way, normally closed.
  .3 Enclosure: Compatible with area classifications indicated on Drawings.
  .4 Working pressure, air and water: 125 PSIG.
.4 Accessories: Provide strainer on supply.

2.6 REDUCED PRESSURE BACKFLOW RPEVENTER

.1 A Reduced Pressure Zone assembly shall be installed at each potential health hazard location to prevent backflow due to backsiphonage and/or backpressure.

.2 The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs.

.3 Seats and seat discs shall be replaceable in both check modules and the relief valve.

.4 There shall be no threads or screws in the waterway exposed to line fluids.

.5 Shall include a bronze quarter turn ball valves and strainer

.6 Service of all internal components shall be through a single access bronze cover secured with stainless steel bolts.

.7 The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks, and an air gap drain fitting.

.8 The assembly shall meet the requirements of USC; ASSE Std. 1013; AWWA Std. C511-92; CSA B64.4.

.9 Shall be a Watts Series 009-QTS.

2.7 SOURCE QUALITY CONTROL

.1 Shop hydrostatically test to unit test pressure.

2.8 MAINTENANCE MATERIALS

.1 Provide one set of any special tools or wrenches required for operation or maintenance for each type valve.

3. EXECUTION

3.1 INSTALLATION

.1 General: See Specification Section 01 61 03 and Specification Section 40 05 51.

.2 Air Release, Vacuum Relief, and Pressure Relief Valves:
  .1 Pipe exhaust to a suitable disposal point.
  .2 Where exhausted to a trapped floor drain, terminate exhaust line 6 IN minimum above floor.

3.2 FIELD QUALITY CONTROL

.1 Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.

.2 Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

END OF SECTION

SECTION 40 05 63
BALL VALVES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Ball valves.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Division 00 - Procurement and Contracting Requirements.

.2 Division 01 - General Requirements.

.3 Section 40 05 51 - Valves - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 ASTM International (ASTM):

.1 A48, Standard Specification for Gray Iron Castings.

.2 A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.3 A276, Standard Specification for Stainless Steel Bars and Shapes.

.4 A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.

.2 American Water Works Association (AWWA):

.1 C507, Standard for Ball Valves, 6 IN through 48 IN.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

.1 SP-110, Ball Valves; Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 DEFINITIONS

.1 PVC: Polyvinyl Chloride.

.2 ECTFE: ethylenechlorotrifluoroethylene.

.3 PVDF: Polyvinylidene fluoride.

.4 PTFE: Polytetrafluoroethylene.

.5 RPTFE: Reinforced PolyTetraFluoroEthylene.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 See Specification Section 40 05 51.

.3 Test results for AWWA valves.

.4 Acknowledgement letter stating:

.1 All of the chemicals on the project.

.2 The wetted materials are compatible with the respective system.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

.2 Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 METALLIC BALL VALVES 1/4 TO 3 IN DIA

.1 Comply with MSS SP-110.

.2 Manufacturers:

.1 Apollo.

.2 Jamesbury.

.3 Watts.

.4 Stockham.

.5 Nibco.

.3 Materials (All Stainless Steel):

.1 Body: Three-part stainless steel, ASTM A351 CF8M.

.2 Ball: Stainless steel ASTM A276.

.3 Seats: RPTFE

.1 All wetted components to be compatible with the service chemical.

.4 Design Requirements:

.1 Rated for a minimum of:

.1 500 PSI CWP.

.2 150 PSI of saturated steam.

.3 29 IN vacuum.

.2 Two-position lockable handle.

.3 Stem with blowout-proof design.

.4 Balancing stop for all applications.

.5 Bodies with mounting pad for applications requiring actuators.

2.3 PLASTIC BALL VALVES: 1/2 IN TO 4 IN DIA

.1 General:
- .1 ECTFE (Halar): refer to Specification 40 05 XX for valve specifications.
- .2 CPVC body valves are to be used within CPVC piping systems.

.2 Manufacturers:
- .1 Basis of Design: Chemline.
- .2 Spears.
- .3 Hayward.
- .4 ASAHI/America.

.3 Valve Materials:
- .1 Body, stem, ball, end connectors:
  - .1 CPVC ASTM D1784-23447-B.
- .2 Handle: ABS.
- .3 Ball Seat: PTFE.
- .4 O-rings: EPDM.
  - .1 All wetted components to be compatible with the service chemical.

.4 Design Requirements:
- .1 Rated at 150 PSI at 75 DEGF.
- .2 Double or "true union" design.
- .3 Blocks both directions, upstream and downstream.
- .4 Union nut capable of compensating for seat wear.
- .5 Body with mounting pad for actuators where required.
- .6 Capable of being disconnected at downstream end under full line pressure.

2.4 ACCESSORIES

.1 Refer to Drawings and valve schedule for type of actuators.
- .1 Furnish actuator integral with valve.

.2 Refer to Specification Section 40 05 51 for actuator requirements.

3. EXECUTION

3.1 INSTALLATION

.1 See Specification Section 40 05 51.

END OF SECTION

SECTION 40 05 64
BUTTERFLY VALVES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Butterfly valves.

.2 Related Sections include but are not necessarily limited to:

.1 Division 00 - Procurement and Contracting Requirements.

.2 Division 01 - General Requirements.

.3 Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

.4 Section 40 05 51 - Valves - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Society of Mechanical Engineers (ASME):

.1 B16.5, Pipe Flanges and Flanged Fittings - NPS 1/2 Through NPS 24.

.2 ASTM International (ASTM):

.1 A48, Standard Specification for Gray Iron Castings.

.2 A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.3 A276, Standard Specification for Stainless Steel Bars and Shapes.

.4 A395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

.5 A436, Standard Specification for Austenitic Gray Iron Castings.

.6 A536, Standard Specification for Ductile Iron Castings.

.3 American Water Works Association (AWWA):

.1 C504, Standard for Rubber-Seated Butterfly Valves.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

.1 SP-67, Butterfly Valves.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 See Specification Section 40 05 51.

.3 For valves 8 IN and larger, furnish "Affidavit of Compliance" with Owner in accordance with AWWA C504.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Bray.

.2 Pentair/Keystone.

.3 DeZurik.

.4 Mueller/Lineseal.

.5 Pratt a Mueller Water Company.

.2 Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 HIGH PERFORMANCE BUTTERFLY VALVES:

.1 General:

.1 Valves MV-001A, MV-005A, MV-007E and MV-008G are to come with motorized operators.

.2 See specification 40 05 51 for operator requirements.

.3 Pump Station P291:

.1 Valves located on the suction side of pumps P-100A and P-200A are to be Class 150:

.1 MV-001A, V-001B, V-100B, V-200B.

.2 Valves located on the discharge of pumps P-100A and P-200A are to be Class 300.

.1 V-100D, V-200D, MV-005A, V-006B, V-007V.

.3 Valve located downstream of FCV-007A is to be Class 150:

.1 MV-007E.

.4 Valve located on the sidestream water supply piping is to be Class 150:

.1 MV-008G.

.4 Pump Station W212:

.1 One new valve is required and is to be Class 150.

.2 Manufacturers:

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable

.1 Basis of Design: Bray / McCannalok

.2 Pentair/Keystone.

.3 DeZurik.

.3 Design Requirements:

.1 Shall be one-piece lug design with extended neck to allow for 2" of piping insulation.

.2 Shall be designed per ASME B16.34.

.3 Seat:

.1 Design shall consist of a resilient energizer totally encapsulated by the seat and isolated from all line media contact.

.2 Lug style design must allow for bidirectional sealing at full rated pressure with the downstream flange removed.

.3 Seat design must be pressure assisted, not pressure dependent.

.4 Seat retainer shall be full-faced and firmly attached by bolts located outside the sealing area to protect them from corrosion. Uninterrupted gasket sealing surface must be maintained for the full flange face.

.5 The seat assembly shall be locked in the body recess by the full-faced retainer.

.6 The seat shall be self-adjusting for wear and temperature changes.

.7 The seat shall provide tight shutoff after one million cycles.

.8 The seat shall be easily field replaceable.

.4 Disc:

.1 Shall be a one-piece design.

.2 Disc edge shall be hand polished for minimum torque and maximum sealing capability.

.5 Stem:

.1 Shall be one-piece design to maximize strength.

.2 Shall be blowout proof design with prevention ring located outside the pressure boundary. Design must fully conform to API 609.

.6 Packing and bearings:

.1 Provided with top and bottom stem bearings consisting of a 316 stainless steel shell with a TFE/glass fabric liner bearing surface.

.2 Equipped with an externally adjustable stem packing system that allows packing adjustment without removing the actuator

.4 Materials of construction:

.1 Body: stainless steel.

.2 Disc: stainless steel.

.3 Stem and pins: 17-4PH stainless steel.

.4 Seals:

.1 Water: PTFE.

.5 Bushings/Bearings: TFE/Glass liner with a 316 Stainless steel shell.

.6 Seat:

.1 Energizer encapsulated in RPTFE or PTFE.

.2 Seat Retainer: Stainless Steel.

2.3 GROOVED BUTTERFLY VALVES

.1 For use in pump station P279.

.2 Design Requirements:

.1 Seat type: Resilient.

.2 Body type:

.1 Grooved end valves 50mm and larger.

.3 Shaft diameter: One-piece constant diameter.

.4 Valves to be ANSI/NSF 61 listed.

.5 Basis of design:

.1 Victaulic Series 861 (potable water service).

.1 Manual valves to c/w gear operator with handwheel.

.2 Body: Stainless steel. Grooved ends to comply with AWWA C606 and C200 pipe end preparation.

.3 Disc: Stainless steel.

.4 Stem: 17-4PH stainless steel.

.5 Seat and seals: EPDM, UL classified in accordance with ANSI / NSF-61 for potable water service.

.6 Handwheel operators.

2.4 ACCESSORIES

.1 Refer to Section 40 05 51 for actuator requirements.

.2 Valve Flange Seal Rings:

.1 If Steel Slip-on flanges are being used on the process piping, flange seals will be required for proper installation of valves.

3. EXECUTION

3.1 INSTALLATION

.1 See Section 40 05 51.

END OF SECTION

SECTION 40 05 66
CHECK VALVES

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Check valves 2.5-inch diameter and smaller.

.2 Swing check valves, three-inch to 24-inch diameter.

.3 Cushioned swing check valves, three-inch to 24-inch diameter.

.4 Ball check valves, 0.5-inch to four-inch diameter.

.5 Duckbill check valves.

.2 Related Requirements: Include but are not necessarily limited to:

.1 Section 40 05 51 - Valves - Basic Requirements.

1.2 REFERENCES

.1 Referenced Standards:

.1 American Society of Mechanical Engineers (ASME):

.1 B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

.2 American Water Works Association (AWWA):

.1 C508, Standard for Swing-Check Valves for Waterworks Service, 2 inches through 24 inches NPS.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):

.1 SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.2 SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Valve Manufacturers:

.1 Manufacturer shall be a business regularly engaged in manufacturing and furnishing check valves of the type required and similar equipment.

.2 Manufacturer shall be able to document having furnished not less than (50) check valves, of the type required, of size equal to or larger than those required for the Work, during the past (five) years.

.3 When requested by Engineer, submit qualifications statement indicating manufacturer's record of manufacturing and furnishing check valves of the types and sizes required and furnish documentation of compliance with qualifications requirements of this Article..

1.4 SUBMITTALS

.1 Action Submittals: Submit the following:

.1 In accordance with Section 40 05 51 - Valves Basic Requirements.

.2 Informational Submittals: Submit the following:

.1 In accordance with Section 40 05 51 - Valves Basic Requirements.

.2 Manufacturer's Instructions:

.1 Manufacturer's written instructions for delivery, handling, storage, installation, and startup.

.3 Closeout Submittals: Submit the following:

.1 Operation and Maintenance Data:

.1 Submit in accordance with Section 01 78 39 - Operations and Maintenance Manuals.

2. PRODUCTS

2.1 TILTING DISC CHECK VALVES: 2 INCHES TO 24 INCHES

.1 Class 250.

.1 Comply with AWWA C508.

.2 Manufacturers:

.1 Water:

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Valmatic 9600 Series

.2 APCO 800 Series

.3 Pratt.

.3 Materials:

.1 Body, cover,: Ductile iron, ASTM A126, Class B.

.2 Disc: Aluminum bronze ASTM B148

.3 Rubber will seal more tightly but will need to be replaced more frequently. If a tight seal is not required, Bronze will provide a longer service life as it is more durable.

.4 Seat ring: Aluminum bronze or rubber (Buna-N).

.5 Pivot pin: Aluminum bronze.

.4 Design Requirements:

.1 Check valve shall have a two-piece body of ductile iron with nominal 55° seal and bronze or stainless steel trunion bearings. Provision shall be provided for the potential installation of a closing snubber dashpot.

.2 The disc shall be of ductile iron and have trunion pins of bronze or stainless located at approximately the 1/3 – 2/3 disc area line.

.3 Fitted to the valve shall be single factory set closed position proximity switch to sense valve opening. This switch shall be rated for and capable of operating a 120 VAC control relay.

.4 Seat ring: Replaceable.

.5 Design pressure: 1860 kPa.

.6 Valve to be ANSI/NSF-61 listed.

2.2 DUCKBILL CHECK VALVES

.1 Manufacturers:

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Red Valve, Tideflex Series TF-1 slide on type.

.2 Proco Products, Series 700 ProFlex Rubber Check Valve.

.2 Description:

.1 Provide at locations shown on the Drawings and as otherwise indicated in the Contract Documents duckbill check valves.

.2 Duckbill check valves provided shall be one-piece, elastomeric, one-way flow devices, installed to allow flow only I the intended direction, without a separate seating surface that is part of the valve.

.3 Shall not freeze open or closed.

.4 Low hydraulic head loss.

.3 Performance Criteria:

.1 Service Application: drain line.

.2 Size: As shown on the Drawings.

.3 Upstream Hydrostatic Head Required for Opening: Two inches of water, maximum.

.4 Downstream Hydrostatic Head: 0 m, maximum.

.4 Materials, Assembly, Fabrication:

.1 Duckbill/Sleeve: EPDM

.2 Mounting to Pipe:

.1 Slide-on type with Type 316 stainless steel mounting bands

.3 Markings: Permanently bond to valve the following information: Manufacturer's business name, valve model, valve size, and serial name.

2.3 PLASTIC BALL CHECK VALVES: 1/2 IN TO 4 IN DIA

.1 General:

ECTFE (Halar): refer to Specification 40 05 XX for valve specifications.

2.4 SOURCE QUALITY CONTROL

.1 Factory Tests and Inspections:

.1 Perform manufacturer's standard factory tests and inspections on materials and equipment furnished. Correct defects prior to shipment to the Site.

3. EXECUTION

3.1 INSTALLATION

.1 Installation – General:

.1 Provide check valves at locations shown and indicated in the Contract Documents.

.2 Install in accordance with the Contract Documents and manufacturer's written instructions. In event of conflict between the Contract Documents and manufacturer's written instructions, obtain written interpretation or clarification from Engineer.

.3 Comply with:

.1 Section 01 61 03 - Equipment - Basic Requirements.

.2 Section 40 05 51 - Valves - Basic Requirements.

.3 Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

.4 Before installing, ensure each check valve is clean and free of dirt and debris.

3.2 FIELD QUALITY CONTROL

.1 Field Tests and Inspections:

.1 Promptly after installing, before installing connecting pipe, verify proper and free operation of check valve.

.2 Hydrostatically test check valves together with associated piping.

.3 To extent practical, prior to Substantial Completion, verify proper operation of each installed check valve.

END OF SECTION

SECTION 40 12 00
COMPRESSED AIR SYSTEM

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Packaged compressed air system including:
  - .1 Reciprocating air compressor with air receiver and controls.
  - .2 Air filters.
  - .3 Air dryers.
  - .4 Air receiver.
- .2 The air compressor to be a package system complete with rotary screw drive, receiver, dryer and acoustic enclosure.

.2 Equipment Numbers:
- .1 AC-036A

.3 Related Sections include but are not necessarily limited to:
- .1 Division 00 - Procurement and Contracting Requirements.
- .2 Division 01 - General Requirements.
- .3 Section 40 05 51 – Valves – Basic Requirements

1.2 QUALITY ASSURANCE

.1 Referenced Standards:
- .1 American Society of Mechanical Engineers (ASME):
  - .1 Section VIII, Division 1, Construction of Pressure Vessels.
- .2 National Electrical Manufacturers Association (NEMA):
  - .1 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .3 National Fire Protection Association (NFPA):
  - .1 70, National Electrical Code (NEC).
- .4 Underwriters Laboratories, Inc. (UL).

1.3 SUBMITTALS

.1 Shop Drawings:
- .1 See Section 01 33 00 for submittal process requirements.
- .2 See Section 01 61 03.
- .3 Fabrication drawings:
  - .1 Air center fabrication drawing showing all tap locations and ASME data plate information.
  - .2 Skid fabrication drawings showing overall dimensions and anchor points.

.3 Show location of all control equipment.

.4 Manufacturer's installation instruction.

.5 Manufacturer's statement of proper installation and start-up.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Air center:

.1 Kaeser Airtower

.2 Equivalent.

.2 Submit request for substitution in accordance with Section 01 25 13.

2.2 AIR COMPRESSOR PACKAGE

.1 A. Equipment Skid:

.1 Complete air compressor package in a single unit

.1 Dimensions:
W x D x H 600 x 1,100 x 1,600 mm

.2 Flow rate:

.1 12 CFM at 125 psi

.3 Receiver volume: 200L

.4 Connection: ¾” NPT

.5 Refrigerated dryer

.6 Maximum sound: 61 dB(A)

.2 Controls:

.1 Furnish HMI based user control system

.1 Sigma Control 2 or equal.

2.3 AIR FILTER

.1 Particulate Filters :

.1 Provide integrated particle filter

.2 Provide with replaceable filter element.

.2 Coalescing Filter

.1 Provide integrated coalescing filter

.2 Provide with replaceable filter element.

2.4 AIR DRYERS

.1 Refrigerated Air Dryer

.1 Provide integrated refrigerated type air dryer

.2 Provide drain valve piped to nearest drain.

2.5 FABRICATION

.1 Complete factory fabricated enclosure complete with acoustic sound insulation.

3. EXECUTION

3.1 INSTALLATION

.1 Comply with Section 01 61 03.

.2 Install products in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

.1 See Section 01 75 00.

.2 Employ and pay for services of manufacturer's representative to:

.1 Inspect final installation.

.2 Supervise startup and perform final adjustments.

.3 Instruct Owner's representative for a minimum of 8 HRS on operation and maintenance procedures.

.4 Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

END OF SECTION

SECTION 40 41 13
HEAT TRACING CABLE

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Heat tracing cable as required for heat tracing of pipes as indicated below and on the Drawings.

.2 Related Sections include but are not necessarily limited to:

.1 Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 National Electrical Manufacturers Association (NEMA):

.1 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Product technical data:

.1 Power requirements for each circuit based upon actual length of heat trace and maintained temperature.

.2 Circuit breaker rating based upon inrush current at minimum expected start-up temperature.

.3 Length of heat tape for each pipe size and run.

.4 Coordinate and verify length and Watts/FT of heat tape required based upon pipe size and insulation thickness.

.1 Include the calculations to support the heat tape output.

.5 See Section 26 05 00 for additional requirements.

.2 Fabrication and/or layout drawings:

.1 Wiring diagrams showing physical locations of thermostats and heat trace power supply.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

.3 Informational Submittals:

.1 Test reports: Megger test results.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Shall be stored such that they are not exposed to sunlight or other UV rays.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

- .1 Chemelex Division; Raychem Corp.
- .2 Chromalox.
- .3 Delta-Therm.
- .4 Thermon.

2.2 HEAT TRACING

.1 Design Parameters:

- .1 Pipe diameter, length and material: See Drawings and relevant piping Specifications.
- .2 Flange, valve, pipe support size: See Drawings and relevant piping Specifications.
- .3 Pipe insulation type and thickness: See Drawings and relevant piping Specifications.
- .4 Temperatures requirements:
  - .1 Low ambient temperature for the specific location: 10 DEGC.
  - .2 Start-up temperature (alarm thermostat set point):
    - .1 Caustic Soda Lines: 15 DEGC.
  - .3 Maintain temperature (power thermostat set point):
    - .1 Caustic Soda Lines: 25 DEGC.
  - .4 High temperature exposure with power off: 30 DEGC.
- .5 Wind factor for the specific location: N/A
- .6 Electrical requirements:
  - .1 Voltage: 120 V.
  - .2 Circuit breaker: Field coordinate if other than 20A GFEPCI type.
- .7 Safety factor: 10%.

.2 Self-regulating or power-limiting parallel circuit construction consisting of an inner core of conductive material between parallel copper bus wires, with inverse temperature - conductivity characteristics with metal overbraid.

.3 Thermostats adjustable between 35 and 200 DEGF minimum with maximum differential range of 9 DEGF, furnished complete with NEMA 4 enclosures in all areas, stainless steel temperature bulb and capillary.

.4 All necessary or required components and accessories, such as power connection boxes, end seals, straps, tape and fitting brackets.

.5 In noncorrosive and nonhazardous locations, insulation shall be Polyolefin.

.6 In corrosive (chemical room), hazardous and hydrocarbon locations insulation shall be Fluoropolymer (Teflon).

3. EXECUTION

3.1 LOCATION AND PIPING

.1 Provide Heat Tracing on the following systems:
  .1 Caustic soda piping (CS) as noted on drawing Y-003
    .1 Transfer pump supply and return
    .2 Dosing pump supply and feed to injection
  .2 Caustic soda tanks (TK-030A; TK-031A)
  .3 Building rainwater leaders and gutters

3.2 PREPARATION

.1 Install materials after piping has been tested and approved.

3.3 INSTALLATION

.1 Insulate and heat trace wet pipe systems as indicated on Drawings.

.2 Install materials in accordance with manufacturer's instructions.
  .1 Each circuit shall not exceed the manufacturer's recommended maximum length.

.3 For Metallic Piping:
  .1 Heat tracing shall be installed completely wired.
  .2 Cut heat trace to lengths as required and secure to pipe with glass or polyester fiber tape.

.4 For Nonmetallic Piping:
  .1 Allow for extra heat trace output because nonmetallic pipe has a lower heat transfer.
    .1 Heat tracing shall be installed completely wired.
  .2 Cut heat trace to lengths as required and secure to pipe with aluminum tape throughout the length of the trace.

.5 Protection and Control Requirements:
  .1 Protection by a GFEPCI circuit breaker.
    .1 Breaker amperage rating shall be coordinated with Contractor when different than the Contract Drawings.
  .2 Provide an ambient sensing thermostat for power and line sensing thermostat for alarm.
  .3 The alarm thermostat shall be placed on the opposite end of the circuit from the power thermostat or power connection to allow for annunciation of partial failure of a circuit or the loss of power from a tripped GFEPCI circuit breaker.
  .4 Provide a monitoring module that monitors the voltage (circuit breaker status) to each circuit.

.5 The alarm from the alarm thermostat and monitor module shall be annunciated on the indicated control system.

3.4 TESTING

.1 Megger the cables at the manufacturers recommended voltage level three times.

.1 Before installation.

.2 After attachment to pipe but before insulation is installed.

.3 After pipe insulation is installed but before energization.

END OF SECTION

SECTION 40 42 00
PIPE, DUCT AND EQUIPMENT INSULATION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Insulation:

.1 Piping insulation.

.2 Adhesives, mastics, sealants, and finishes.

.2 Related Specification Sections include but are not necessarily limited to:

.1 Section 40 05 07 - Pipe Support Systems.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 ASTM International (ASTM):

.1 C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded-Hot-Plate Apparatus.

.2 C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.3 C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.4 C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.5 C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.6 C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.7 D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

.8 E96, Standard Test Methods for Water Vapor Transmission of Materials.

.9 F25, Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas.

.10 C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.11 E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

.12 E119 Standard Method of Fire Tests of Building Construction, 2 Hour Wall Panel Test, 2 Hour External Total Engulfment Test, hose stream evaluation.

.13 E136, Combustion Characteristics of Building Materials in a Vertical Tube Furnace.

.14 E162, Surface Flammability of Materials.

.15 E814, Through-Penetration, 2-Hour Firestop Test.

.16 E2336: Standard Test Methods Fire Resistive Grease Duct Enclosure Systems.

.2 ISO 6944-1985, Method of Determining Fire Resistance of Ventilation Ducts.

.3 National Fire Protection Association (NFPA):

.1 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

.4 Underwriters Laboratories, Inc. (UL):

.1 723, Standard for Test for Surface Burning Characteristics of Building Materials.

.5 National Commercial and Industrial Insulation Standards (2013 seventh edition).

.1 Published by Midwest Insulation Contractors Association (MICA).

.2 Endorsed by National Insulation Association (NIA).

.3 MICA plate numbers listed in this specification reference this document.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.3 Submit complete specification of insulation materials, adhesives, cement, together with manufacturer's recommended methods of application and coverage for coatings and adhesives.

.3 Submit itemized schedule by building of proposed insulation systems showing density, thermal conductivity, thickness, adhesive, jackets and vapor barriers.

.4 Certifications: Products will meet the requirements of the Contract Documents.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Fiberglass insulation:

.1 CertainTeed Corporation.

.2 Johns Manville.

.3 Owens Corning.

.4 Knauf.

.2 PVC jacket:

.1 Ceel-Co.

.2 PIC Plastics.

2.2 PIPING INSULATION - FIBERGLASS

.1 Pipe and Fitting Insulation:

.1 Preformed fiberglass pipe insulation:

.1 Density: 4 LBS/CUFT.

.2 Temperature rated: 650 DEGF.

.3 Average thermal conductivity not to exceed 0.23 (BTU-IN)/(HR-FT^2-DEGF) at mean temperature of 75 DEGF.

.4 Fire hazard rating:

.1 UL 723, ASTM E84, NFPA 255.

.2 Flame spread not exceeding 25 and smoke developed not exceeding 50.

.2 Moisture adsorption:

.1 ASTM C553.

.2 Not greater than 5% moisture by volume when exposed to moisture laden air at 120 DEGF and 96% RH.

.3 Fungi and bacteria resistance:

.1 ASTM C665.

.2 Does not breed or promote growth.

.3 Flame attenuated glass fibers bonded with thermosetting resin.

.4 Piping jackets (general applications):

.1 Aluminum: 16 MIL embossed aluminum.

.2 PVC: Preformed 0.028 IN thick PVC jackets fabricated from B.F. Goodrich PVC sheeting V-66 with proven resistance to ultraviolet degradation when temperatures do not exceed the limits of PVC.

.3 Piping jacket not required on concealed piping.

3. EXECUTION

3.1 INSTALLATION

.1 Install products in accordance with manufacturer's instructions.

.2 General:

.1 Piping below ground covered with earth will not be insulated.

.2 Provide release for insulation application after installation and testing is complete.

.1 Apply insulation on clean, dry surfaces after inspection.

.3 Provide insulation continuous through wall, roof and ceiling openings, pipe hangers, supports and sleeves.

.4 Apply specified adhesives, mastics and coatings at the manufacturer's recommended coverage per unit volume.

.3 Piping Insulation - Fiberglass:

.1 Apply over clean dry pipe.

.1 Butt all joints together firmly.

.2 Seal joints, slits, miter-cuts and other exposed edges of insulation as recommended by the insulation manufacturer.

.3 Insulate fittings, valves, and flanges with insulation thickness equal to adjacent pipe.

.4 PVC pipe jacket:

.1 Apply jacketing with a minimum of 1 IN overlap.

.1 Weld longitudinal and circumferential seams with adhesives as recommended by manufacturer.

.2 Provide slip-joints every 30 FT and between fittings if distance exceeds 8 FT.

.1 Construct slip-joints by overlapping jacket sections 6 to 10 IN.

.3 Provide pre-molded PVC covers of same material and manufacturer as jacket for fittings, valves, flanges, and related items in insulated piping systems.

3.2 REPAIR

.1 Whenever any factory applied insulation or job-applied insulation is removed or damaged, replace with the same quality of material and workmanship.

3.3 SCHEDULES

.1 Pipe, Fittings and Valves:

.1 Fiberglass.

APPLICATION	PIPE SIZE	THICKNESS	JACKET
Caustic Soda	2 IN	1 IN	PVC
W212 supply pipe	8 IN	2 IN	Aluminum

END OF SECTION

SECTION 43 21 00
PUMPING EQUIPMENT - BASIC REQUIREMENTS

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Pumping equipment.

.2 Related Specification Sections include but are not necessarily limited to:
- .1 Division 00 - Procurement and Contracting Requirements.
- .2 Division 01 - General Requirements.
- .3 Section 01 61 00 – Common Product Requirements.
- .4 Section 46 33 11 – Chemical Treatment Systems and Equipment.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:
- .1 ANSI/Hydraulic Institute (ANSI/HI):
  - .1 9.6.3, Rotodynamic (Centrifugal and Vertical) Pumps – Guideline for Allowable Operating Region.
  - .2 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
  - .3 9.6.6, Rotodynamic Pumps for Pump Piping.
  - .4 9.8, Rotodynamic Pumps for Pump Intake Design
  - .5 11.6, Rotodynamic Submersible Pump for Hydraulic Performance, Hydrostatic Pressure, Mechanical, and Electrical Acceptance Tests.
  - .6 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.

.2 Coordinate all mechanical seal systems specified to ensure pump and seal compatibility.

.3 Pump/motor and VFD coordination: See Specification Section 01 61 03.

1.3 DEFINITIONS

.1 The abbreviations used in this section are defined as follows:
- .1 AOR: Allowable Operating Range.
- .2 BEP: Best Efficiency Point.
- .3 IPS: Iron Pipe Size.
- .4 NPSH3: Net Positive Suction Head for 3 PCT head loss.
- .5 POR: Preferred Operating Range.
- .6 TDH: Total Dynamic Head.
- .7 TEFC: Totally Enclosed Fan Cooled.
- .8 VFD: Variable Frequency Drive.

.2 Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 See Specification Section 01 61 03.

.3 Product technical data including:

.1 Performance data and curves with flow (GPM), head (FT), horsepower, hydraulic efficiency, rotating speed (RPM), AOR, BEP, POR, NPSH3 requirements, minimum bowl submergence requirements for vertical mixed flow, axial and turbine pumps.

.2 Pump accessory data.

.3 Bearing supports, shafting details and lubrication provisions.

.1 Bearing life calculations.

.2 Critical speed calculations.

.4 Solids passage information.

.4 Certifications:

.1 Certified pump performance curves as described in the SOURCE QUALITY CONTROL Article.

.2 Verification of Primary and Secondary conditions in POR and AOR.

.5 Test reports:

.1 Factory hydrostatic test.

.2 Reed Critical Frequency test.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

.3 Informational Submittals:

.1 Certifications:

.1 Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Pumps:

.1 Vertical Turbine Pumps - See individual pump Specification Sections.
.2 Submersible Well Pumps – See individual pump Specification Sections.
.3 Chemical Transfer Pump – Refer to 2.3

.2 Mechanical seals:
.1 Chesterton.
.2 John Crane.
.3 Garlock.
.4 Flowserve.
.5 Or as noted in the individual pump Specification Sections.

.2 Submit request for substitution in accordance with Specification Section 01 25 00.

2.2 CENTRIFUGAL PUMP DESIGN

.1 Provide units with increasing head characteristics from the end run out portion of the curve to:
.1 Shut-off condition.

2.3 CHEMICAL TRANSFER PUMP (CP-036A)

.1 Type: Self Priming Sealless Mag Drive corrosion resistant pump design
.2 Exposure: 50% Caustic Soda
.3 Configuration: Horizontal
.4 Construction Material: Polypropylene
.5 Connection: NPT
.6 O-Rings: EPDM
.7 Bushings: PTFE
.8 Shaft: Hastelloy
.9 Flow: 2 L/s at 8,0m TDH
.10 Power: 120/208V

2.4 ACCESSORIES

.1 See Specification Section 01 61 03.

.2 Each Unit:
.1 Lifting eye bolts or lugs.
.2 Plugged gage cock connection at suction and discharge nozzles.
.3 Tapped and plugged openings for casing and bearing housing vents and drains.
.4 Fittings for properly adding flushing lubricant.
.5 Pressure relief fittings for grease lubrication.

.3 Mechanical Seals:
.1 Provide as specified in the narrow-scope pump sections.

.2 Provide rotating balanced O-ring type.

.3 Provide water lubrication - cooling

.4 Materials:

.1 Metal parts except springs: 316 stainless steel.

.2 Springs: Hastelloy C.

.3 Seal faces: Unfilled carbon graphite versus silica-free Grade 99.5 ceramic.

.4 Elastomers: Viton.

2.5 FABRICATION

.1 Pump Support:

.1 Design base to support weight of drive, shafting and pump.

.2 Comply with HI vibration limitations.

.3 Mount horizontal pump, motor and coupling on single piece drip lip type baseplate.

.4 Mount vertical pumps on single piece pedestal baseplate.

.5 Fabricate to withstand all operating loads transmitted from the pump and drive.

.6 On vertically configured end suction centrifugal pumps when supplied with a fabricated steel mounting frame and suction elbow, the suction elbow shall be a long radius reducing elbow with greater than 50 PCT area reduction to comply with Table 9.6.6.3.2 of ANSI/HI 9.6.6 standard for straight pipe lengths.

2.6 SOURCE QUALITY CONTROL

.1 Verification primary design condition in POR.

.2 Verification secondary design condition in AOR.

.3 Factory hydrostatic test all pumps at 150 PCT of shut-off head for a minimum of five minutes.

.4 If specifically required in the individual pump specification sections, provide factory tests:

.1 All units:

.1 Conduct tests in accordance with HI.

.1 Shut-off head and design condition: Positive unilateral performance tolerance meeting Grade 1U per ANSI/HI 14.6 for Rotodynamic Pumps.

.2 Shut-off head and design conditions: Positive unilateral performance tolerances meeting Grade 1U per ANSI/HI 11.6 for Rotodynamic Submersible Pumps.

.2 All pumps:

.1 Head (FT) versus flow (GPM) pump curves:

.1 Efficiencies along curve.

.2 Brake horsepower along each curve.

.3 Results certified by a registered professional engineer.

.5 Statically and dynamically balance each pump per ANSI/HI standards.

.1 If specifically required in the individual pump specification sections or in Specification Section 01 61 03, field vibration test pumps:

.1 To meet requirements of ANSI/HI 9.6.4 for Rotodynamic Pumps at any point on the pumps and motor.

3. EXECUTION

3.1 INSTALLATION

.1 See Specification Section 01 61 03.

.2 Floor or Pad-Mounted Units (Non-Submersible):

.1 Align vertically and horizontally level, wedge and plumb units to match piping interfaces.

.2 Assure no unnecessary stresses are transmitted to equipment flanges.

.3 Tighten flange bolts at uniform rate and manufacturer's recommended torque for uniform gasket compression.

.4 Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.

.5 Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.

.6 Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.

.7 Assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.

.1 Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.

.2 Realign as necessary, install flange bolts and make equipment connection.

.8 Field paint units as defined in Specification Section 09 96 00.

.9 Provide pressure gage, visible from grade or operating floor, on discharge of all pumps and on suction and discharge of all non-submersible units.

.3 Submersible Units:

.1 Assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.

.1 Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.

.2 Realign as necessary, install flange bolts and make equipment connection.

.2 Field paint units as defined in Specification Section 09 96 00.

.3 Provide discharge pressure gage visible from grade or operating floor.

3.2 FIELD QUALITY CONTROL

.1 Provide services of equipment manufacturer's field service representative(s) to:

.1 Inspect equipment covered by this Specification Section.

.2 Supervise pre-start adjustments and installation checks.

.3 Conduct initial start-up of equipment and perform operational checks.

.4 Instruct Owner's personnel for the specified minimum number of hours at jobsite per Specification Section 01 33 00 on operation and maintenance of each of following pumping equipment:

.1 Section 43 23 15 – Submersible Well Pump 4 HRS

.2 Section 43 24 27 - Pumping Equipment - Vertical Turbine (Line Shaft), 4 HRS.

END OF SECTION

SECTION 43 23 15
SUBMERSIBLE WELL PUMP

1. GENERAL

1.1 APPLICATION

.1 This specification refers to the supply, delivery and installation of:

.1 One submersible pumping unit with submersible motor.

.2 Discharge riser pipe and check valve.

.2 Dimensioned sketches shall be included with illustrated literature describing the proposed equipment.

.3 The new pump is to be installed within an existing well utilizing an existing Maass Midwest Model MB pitless unit and spool. See the Pump Set Record from May 20, 2017, at the end of this section for existing well and pump installation information.

.4 The existing pump is to be decommissioned and removed from service.

.5 A new 150mm (6”) column pipe and 150mm (6”) check valve are to be provided. The column length is to allow for the pump to be installed as same elevation as on the Pump Set Record. A 150 x100mm (6 x 4”) reducer is to be provided at the top of the column pipe to mate with the existing pitless unit.

.6 Motor control will be with a new variable speed drive. Pump motor control will be varied to provide for a set discharge flowrate or a set well level.

.7 A flow inducer sleeve is to be provided proper motor cooling flow.

.8 Well level will be measured with a new level transducer which is to be installed into a new level transducer insert tube which shall be attached to the discharge riser pipe by means of vinyl electrical tape applied in a 50mm wide multi-wrap band a minimum of every 2m.

.9 Contractor to coordinate installation of new well pump with well redevelopment specification.

1.2 STANDARDS

.1 Where applicable, the equipment and materials supplied under this specification shall meet the Hydraulic Institute Standards, the Canadian Government Specification Board Standards, the Standards of the Electrical and Electronic Manufacturer's Association of Canada and the Canadian Standards Association. All equipment shall be new.

2. PRODUCTS

2.1 SUBMERSIBLE PUMPING UNIT

.1 The submersible raw water pumps shall be water lubricated, multistage, submersible motor driven and have a maximum external diameter of 250 mm (10”).

.2 The pump shall be designed to satisfy the following conditions:

Rated Capacity Litres/second	Total Dynamic Head (TDH) at Rated Capacity Metres
40	27.6

.3 Pump shutoff head shall be minimum 50m.

.4 Pump impellers and diffusers shall be fabricated from 300 series stainless steel and the pump discharge shall incorporate an integral check valve.

.5 Intermediate bowls shall have polymer bearings to support and guide the shaft and lend resistance to sand abrasion wear on the shaft bearing surface.

.6 The suction screen shall be of 300 series stainless steel with a net open area at least four times the area of the impeller eye.

.7 Pump discharge shall be 150mm (6") FNPT.

.8 Submersible pump shall be Grundfos 625S300-2AA.

.9 Integrally mounted with each pump shall be a water filled 30 HP Franklin #2366268120 Sandfighter submersible motor with a minimum 1.15 service factor and sufficient continuous thrust capacity. Motor operating efficiency shall not be less than 70% and the nameplate rating of the motor shall not be exceeded. Motor shall be suitable for 575 Volt, 60 Hz, three phase service.

.10 Approved alternate pump manufacturer: Franklin.

.11 A flow inducer sleeve is to be provided to provide cooling flow across the motor. Sleeve to be 300mm (12") diameter and span the full motor length. See the Franklin Electric 2023 AIM Manual for flow inducer sleeve design requirements.

.12 The Contractor shall be responsible for ensuring that the installation of pumping equipment fully complies with the requirements of the pump manufacturer, and shall provide a letter of certification that these requirements have been met.

2.2 SUBMERSIBLE PUMP CABLE

.1 Motor leads shall be protected for the entire length of the bowl assembly by a 300 series stainless steel cable guard supplied with the pump.

.2 Type TWU or RWU stranded submersible pump cable shall be sized such that the voltage drop will not exceed 3% from the power source to the motor at full load current.

.3 Power conductors shall be spliced to the motor leads within the well using crimp connectors and heavy duty heat shrink insulation with adhesive. T&B HS Series approved.

.4 Included shall be a ground conductor terminating at a motor stud ring connector.

.5 Pump cable shall be attached to the discharge riser pipe by means of vinyl electrical tape applied in a 50mm wide multi-wrap band a minimum of every 2m.

2.3 DISCHARGE COLUMN PIPE

.1 Column pipe shall be random length (4.8m-6.7m, or 16'-22') nominal 150mm (6") Schedule 40 steel pipe with standard merchant taper tapped threaded couplings.

.2 Provide a 150mm (6") poppet type check valve of ductile iron construction with stainless steel trim. Shall be FloMatic Model 80DI-VFD and be installed within 1 pipe length to the pump.

.3 The column length is to allow for the pump to be installed as same elevation as on the Pump Set Record.

.4 Contractor to supply a 150 x100mm (6 x 4") reducer is to be provided at the top of the column pipe to mate with the existing pitless unit.

.5 All pipe internals and externals are to be prepared, NSF-61 coated and inspected/tested in accordance with the latest version of AWWA C210.

.6 All threaded riser pipe ends shall be checked utilizing an NPT screw ring gauge, and this shall be demonstrated to the Engineer on request.

.7 Pump cable shall be attached to the discharge riser pipe by means of vinyl electrical tape applied in a 50mm wide multi-wrap band a minimum of every 2m.

2.4 CHECK VALVE

.1 Provided shall be a 150mm (6") low head loss dual poppet type check valve of ductile iron construction with stainless steel trim and integral break-off plug.

.2 Shall be Flomatic Model 80DI VFD.

.3 Note that check valve to be installed one pipe length above pump and one check valve is to be installed one pipe length below pitless unit.

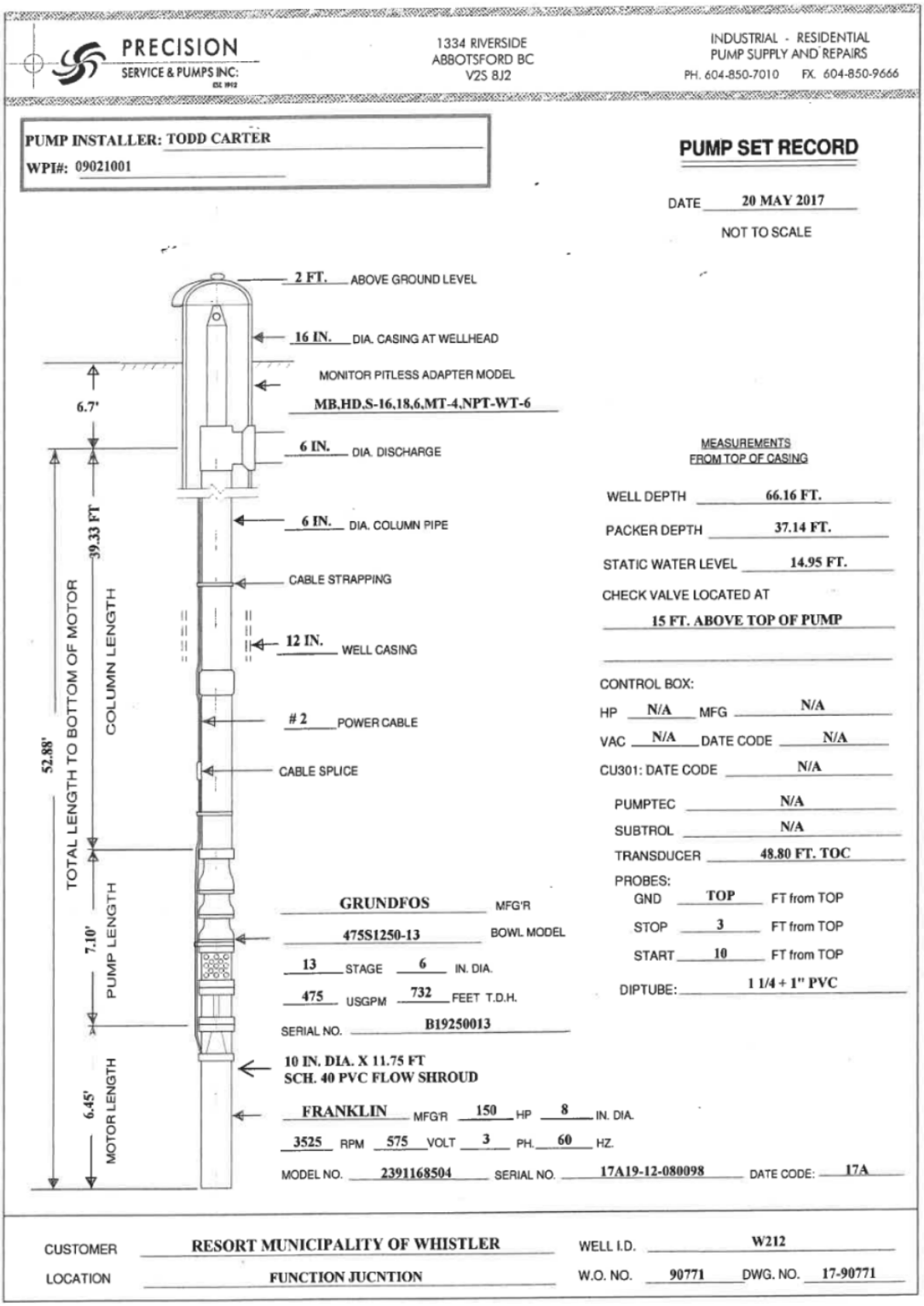
.4 A suitable lamicoid, having white letters on black background, shall be provided for field attachment where appropriate.

.5 Pump check valve equipped with break-off drain plug

3. EXECUTION

3.1 TESTING

.1 The Contractor shall be responsible for ensuring that the installation of submersible pumping equipment fully complies with the requirements of the pump manufacturer, and shall provide a letter of certification that these requirements have been met.



PRECISION SERVICE & PUMPS INC.
1334 RIVERSIDE
ABBOTSFORD BC
V2S 8J2
INDUSTRIAL - RESIDENTIAL
PUMP SUPPLY AND REPAIRS
PH. 604-850-7010 FX. 604-850-9666

PUMP INSTALLER: TODD CARTER
WPI#: 09021001

PUMP SET RECORD

DATE 20 MAY 2017

NOT TO SCALE

MEASUREMENTS FROM TOP OF CASING

WELL DEPTH 66.16 FT.
PACKER DEPTH 37.14 FT.
STATIC WATER LEVEL 14.95 FT.
CHECK VALVE LOCATED AT
15 FT. ABOVE TOP OF PUMP

CONTROL BOX:
HP N/A MFG N/A
VAC N/A DATE CODE N/A
CU301: DATE CODE N/A
PUMPTEC N/A
SUBTROL N/A
TRANSDUCER 48.80 FT. TOC
PROBES:
GND TOP FT from TOP
STOP 3 FT from TOP
START 10 FT from TOP
DIPTUBE: 1 1/4 + 1" PVC

CUSTOMER RESORT MUNICIPALITY OF WHISTLER
WELL I.D. W212
LOCATION FUNCTION JUCNTION
W.O. NO. 90771 DWG. NO. 17-90771

END OF SECTION

SECTION 43 24 27

PUMPING EQUIPMENT - VERTICAL TURBINE (LINE SHAFT)

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Vertical turbine pumps for P291.

.2 Pump Equipment Numbers:

.1 P-100A

.2 P-200A

.3 Related Sections include but are not necessarily limited to:

.1 Division 00 - Procurement and Contracting Requirements.

.2 Division 01 - General Requirements.

.3 Section 01 61 03 - Equipment: Basic Requirements.

.4 Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

.5 Section 43 21 00 - Pump Equipment - Basic Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Society of Mechanical Engineers (ASME):

.1 B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

.2 American Iron and Steel Institute (AISI)

.1 1045 Medium Carbon Steel

.3 Hydraulic Institute (HI)

1.3 SUBMITTALS

.1 Shop Drawings:

.1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

.2 Product technical data including:

.1 Acknowledgement that products submitted meet requirements of standards referenced.

.2 Manufacturer's installation instructions.

.3 See Sections 01 61 03 and 43 21 00.

.2 Contract Closeout Information:

.1 Operation and Maintenance Data:

.1 See Specification Section 01 78 39 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Flowserve

.2 Goulds

.3 National.

.2 Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

.1 Performance Parameters:

.1 Equipment numbers P-100A, P-200A

.1 Notes:

.1 Water supply will be from reservoir R226 (Cheakamus). Static head is approximately 111m.

.2 Pumps will operate as Duty-Standby and pump from P291 to reservoir R228 (Creekside). Static head to R228 is about 160m.

.3 The design condition is based on a worst case pumping scenario from an empty supply reservoir to a full destination reservoir.

.4 The following equipment design information is based upon the Flowserve 12EHL-5 pump.

.2 Primary design conditions:

.1 75 L/s at 72.4m TDH with one pumps operating at minimum 79% efficiency.

.2 Flow Relative to BEP (PCT range): 90% to 115%.

.3 Secondary design condition:

.1 60 L/s at 89m TDH and minimum 80 PCT efficiency.

.2 Flow Relative to BEP (PCT): >75%.

.4 Minimum shutoff head condition: 120m.

.5 Drive type: Variable speed drive.

.6 Maximum pump speed: 1800 rpm.

.7 Nameplate drive horsepower: 100.

.2 Provide pumps with increasing head characteristics from secondary design conditions to shutoff condition. Provide pumps with net positive suction head requirements (NPSHR) less than the net positive suction head available (NPSHA) at all operating conditions.

2.3 ACCESSORIES

.1 See Section 01 61 03.

2.4 COMPONENTS

.1 Pumping Unit NSF Certification:

.1 The complete pumps, as an assembled unit, shall be certified to NSF/ANSI Standard 61 and Annex G and meet the requirements of the US Safe Drinking Water Act of 2014. The new pumping units shall include an additional nameplate displaying NSF-G certification. Units that have NSF materials and NSF coating only that are not NSF certified units will not be considered equal or acceptable.

.2 General:

.1 Furnish units consisting of a vertical shaft turbine, coupled to a vertical solid shaft motor. Design unit with non-reversing ratchets.

.2 Weight of revolving parts of pump including unbalanced hydraulic thrust of impeller is carried by thrust bearing in driver.

.3 Make provision at driver shaft for adjusting impeller with reference to bowls.

.4 The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, baseplates, pump inlet barrels, couplings, guards, and other accessories as specified herein.

.5 The pumps, motors, drives, couplings and base plates shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, without damaging cavitation, and without excessive vibration or noise.

.6 Reed Critical Frequency test to be performed and test results provided as a shop drawing submittal.

.7 In order to ensure that neither harmful nor damaging vibrations occur to the pump structure at any speed within the specified operating range, the following analysis shall be required:

.1 Pump manufacturer shall perform a structural frequency analysis of the above ground structural components utilizing a FEA method to ensure that no structural frequencies occur within +/-15% of the operating speed range or -50% to -30% operating speed range. When deemed necessary by the experience of the manufacturer, the below ground structural components shall also be included in the analysis.

.2 The FEA method should include the use of ProE/Mechanica or an equivalent software. All pump assembly components, including the motor, shall be represented as solid elements, and if idealizations are used in place of solid elements, then a complete description of method for the idealization shall be included in the report. The analysis shall also include all modes of interest and pictorially represent them in a fringe plot format. Modes of interest are defined as those structural frequencies that exist below 120% of the maximum operating speed. When significant modifications are required to lower the system's natural frequency, the pump structure's stresses and deflections shall also be reviewed.

.3 Manufacturer to provide documentation of the analysis ensuring that the specified requirements have been met, and that documentation should be signed and stamped by the professionally licensed engineer who performed the analysis work.

.4 Vibration

.1 When measured in the direction of maximum amplitude on the pump, shall not exceed limits given in the latest ANSI/HI nomograph for the applicable pump type.

.3 Column:

.1 Construct discharge column pipe of steel and supply with flanged connections.

.2 Abrasive blast column and coat with a minimum 15 mils dry film thickness epoxy system at the factory.

.4 Open Line Shaft:

.1 Line shaft to be fabricated from 416 stainless steel.

.2 Provide rubber bearings at each column connection supported by retainers butted between machined faces of discharge column.

.5 Pump Bowl and Suction Bell:

.1 Provide bowl and suction bell constructed of close grained cast iron, free from imperfections and accurately machined and fitted.

.2 Coat pump bowl water passages with an abrasion-resistant baked enamel, phenolic or epoxy.

.3 Provide coating suitable for potable water service.

.4 Design to ensure easy removal of bearings and impeller.

.5 Furnish suction bell with flared end to reduce entrance losses and with a sufficient number of vanes to support lower guide bearings and weight of impeller and pump shaft when dismantling pump.

.6 Bearings:

.1 In bowl, provide main bronze bearing immediately above impeller and a lower bronze bearing immediately below impeller.

.2 Provide for lubrication of bowl bearings with pumped liquid.

.3 Furnish suction bell bearing having minimum length equal to five shaft diameters.

.7 Pump Shaft and Impeller:

.1 Provide pump shafts and bowl shafts constructed of rolled and ground 416.

.2 Furnish enclosed type impellers constructed of bronze and securely attached to impeller shaft.

.3 Ensure impeller is accurately fitted and statically and dynamically balanced.

.4 Provide bronze replacement wear rings in each bowl to prevent wear on bowls.

.8 Discharge Head Assemblies:

.1 Design a carbon steel discharge head assembly for 250 PSI working pressure and 375 PSI test pressure.

.2 Provide discharge head for above ground mounting constructed of fabricated steel with integral supply and discharge flanges. Discharge head shall be suitable for pump VFD operation.

.3 Furnish ASME B16.1:

.1 125/150LB inlet flange.

.2 250/300LB discharge flange.

.4 Construct discharge nozzle with a vertical vane to minimize turbulence.

.5 The discharge head base shall be circular with a flat machined lower face and bolt drilling dimensions per a standard ANSI flange size.

.6 Sufficient space shall be provided above the gland for access to a spacer-type flanged adjustable solid shaft motor coupling, which shall also be provided. The basic discharge head shall be one-piece type, without separate spacer ring. A bronze shaft guide sleeve bearing shall be furnished below the gland.

.7 Protective screens shall be provided to cover the access areas for the coupling and mechanical seal/packing.

.8 Provided with the pump head shall be a ½" threaded connection for venting the mechanical seal flush to the pump inlet.

.9 Discharge head air release valve:

.1 Provision for a ½" inlet barrel air release valve is to be provided with the pump head lower flange.

.9 Pump Inlet Barrel

.1 Pump inlet barrels required for the installations.

.2 Pump inlet barrels to be design to Hydraulic Institute standards and fabricated from carbon steel.

.3 The top support plate of the barrel shall be provided, drilled and tapped to accept head base bolts. Flange connection shall be gasketed. The support plate of the barrel shall be provided with studs per a standard ANSI flange size. Inside the stud circle, the plate shall be machine grooved for a nominal 6 mm (1/4") sealing O-ring. This machined groove shall be properly dimensioned for dynamic O-ring sealing when mated with the discharge head. Required O-ring shall also be furnished.

.4 Inlet barrel shall be concrete encased as outlined on drawings.

.10 Shaft Sealing

.1 A sleeve mounted cartridge type inside mechanical seal assembly shall be installed on the pump discharge head.

.2 Gland plate shall be of 300 series stainless steel with a 10mm FNPT vent tapping adjacent to the seal face.

.3 Sleeve to rotating face seal shall be a full convolution elastomeric bellows with single coil pressure spring.

.4 Rotating face shall be self-aligning, tolerant of shaft end play and run out.

.5 Contact faces shall be carbon (rotating) / silicon carbide (stationary).

.6 Seal hardware, including sleeve, shall be of shall be of 300 series stainless steel.

.7 The cartridge sleeve shall be positioned on the pump head shaft by means of at least two setscrews. Removable spacer inserts shall permit the sleeve to be positioned relative to the gland plate before shaft lateral is adjusted.

.8 Mechanical seal shall be Flowserve ISC2 or John Crane Type 5610 (SB1).

.9 Mechanical seal flushing plans:

.1 Plan 13.

.2 A ½" tube shall be installed from flush outlet to a fluid return port on the discharge head base. ½" tube and fittings shall be of 300 series stainless steel.

.11 Data Plates:

.1 Provide stainless steel data plate securely attached to pump.

.2 Include manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.

.12 Motors:

.1 Reduce voltage starting, solid shaft, squirrel cage, induction type.

.2 600 V, 60 HZ, 3 PH, Inverter Duty

.3 WP-I type with 1.15 service factor.

.4 Size motor to drive pump continuously over the complete head - capacity range without the load exceeding the nameplate rating.

.5 Comply with Section 01 61 03.

2.5 MAINTENANCE MATERIALS

.1 Extra Materials:

.1 Furnish the Owner the following extra parts for each pump service category:

.1 Lower bearing assembly: One set.

.2 Upper bowl bearing: One set.

.3 Line shaft bearing assemblies: One set.

.4 Mechanical seal: One.

.5 Wearing rings: One set.

.6 Pump head o-ring (sealing between inlet barrel flange and pump head flange): two.

3. EXECUTION

3.1 INSTALLATION

.1 Install products in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

.1 See Section 43 21 00.

END OF SECTION

SECTION 43 41 45
FIBERGLASS REINFORCED PLASTIC TANKS FINAL

1. GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Two vertical 50% caustic soda storage tanks.
- .2 Equipment Numbers
  - .1 TK-030A
  - .2 TK-031A

.2 Related Specification Sections include but are not necessarily limited to:
- .1 Division 01 - General Requirements.

1.2 QUALITY ASSURANCE

.1 Referenced Standards:
- .1 American National Standards Institute (ANSI):
  - .1 B16.5, Pipe Flanges and Flanged Fittings.
- .2 ASTM International (ASTM):
  - .1 C582, Standard Specification for Reinforced Plastic Laminates for Self-Supporting Structures for Use in a Chemical Environment.
  - .2 D3299, Specification for Filament-Wound-Glass Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks.
  - .3 D4097, Specification for Contact Molded Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks.
  - .4 D2563, Standard Practice for Classifying Visual Defects in Glass- Reinforced Plastic Laminate Parts.

1.3 SUBMITTALS

.1 Shop Drawings:
- .1 See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- .2 Product technical data including:
  - .1 Acknowledgement that products submitted meet requirements of standards referenced.
  - .2 Manufacturer's installation instructions.
  - .3 Complete information on basic materials including chemical resistance charts.
  - .4 Sizes of all major tank components.
  - .5 Details on nozzle and other openings lay-up.
  - .6 Details on field assembly and installation.

.7 Fitting locations.

.8 Approved chemical storage.

.9 Manufacturer's available gel coat colours.

1.4 WARRANTY

.1 Provide manufacturer warranty that the Equipment will be delivered free from defects in material and workmanship. Defects will be promptly repaired by the provision of a replacement part or repair the tank at the Owner's site by the manufacturer or a certified repair technician.

.2 The Warranty Period to be the earlier of the twelve (12) months from initial operation or eighteen (18) months from shipment date.

1.5 SHIPPING

.1 Pricing to include all costs for shipping and duties necessary to deliver the tanks to:

Resort Municipality of Whistler
P291
1135 Cheakamus Lake Road
Whistler, BC

2. PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Fiberglass reinforced plastic tanks:

.1 Precisioneering.

.2 Diamond Fiberglass

.3 Augusta Fiberglass

.2

2.2 MATERIALS

.1 General:

.1 Resins:

.1 Derakane 411-350 or

.2 Derakane 510B.

.2 Reinforcement:

.1 Surfacing veil: Double Type C glass for sodium hypochlorite exposure.

.2 Chopped strand mat: Type ECR glass with silane finish and styrene-soluble binder.

.3 Exposed metal: Stainless steel, ANSI Type 316.

.4 Lifting lugs: Stainless steel, ANSI Type 304.

2.3 ACCESSORIES

.1 Flanges Nozzles:

.1 Conically gusseted to tank, withstand 250 LBS bending, 1,500 FT/LBS torque.

.2 Flange diameter and drilling per ANSI B16.5, 150 LB.

.3 At least 4 IN from outside face.

.4 Same material as tank.

.5 Location and sizes as shown on Drawings.

.2 Vents: at the top of each tank.

.3 Handling lugs.

.4 Manway:

.1 One 600 mm (24 IN) DIA access side manway.

.2 Flange diameter and drilling per ANSI B16.5, 150 LB or ASTM D3299.

.3 60 durometer 1/8 IN thick full-faced Viton gaskets.

.5 Table of Fittings

TK-030A				
Fitting	Dia. (mm)	Location	Type	Orientation
Exterior Fill	50	Top	Flange	300
Transfer Fill	50	Top	Flange	270
Vent	150	Top	Flange	225
Overflow	75	Side at Top	Flange	45
Outlet	50	Side at Bottom	Flange	135
Instrument	100	Top	Flange	180
TK-031A				
Fitting	Dia. (mm)	Location	Type	Orientation
Exterior Fill	50	Top	Flange	300
Transfer Fill	50	Top	Flange	270
Vent	150	Top	Flange	225
Overflow	75	Side at Top	Flange	135
Outlet	50	Side at Bottom	Flange	45
Instrument	100	Top	Flange	180

2.4 FABRICATION

.1 Size and Dimensions:

.1 Chemical Storage Tanks:

.1 Number of tanks: Two.

.2 Nominal capacity: 12,000 L.

.3 Approximate diameter: 2.7 m (9’)

.4 Approximate working height (overflow above working height): 2.0 m (6’8”)

.2 Shape: Cylindrical with flat bottom and top.

.3 Service Conditions:

.1 Fluid: 50% NaOH.

.2 Pressure: Atmospheric.

.3 Specific gravity: 1.522

.4 Maximum temp.: 30 C maximum.

.4 Design Loads:

.1 Seismic requirements: BC Building Code for Whistler, BC.

.1 Sa(0.2) = 0.438; Sa(0.5) = 0.357; Sa(1.0) = 0.233; Sa(2.0) = 0.152; Sa(5.0) = 0.058; Sa(10.0) = 0.020.

.2 PGA = 0.203; PGV = 0.296

.2 Concentrated top load: 150 kg/sq.m plus dead load.

.5 Design: Per ASTM D3299, ASTM D4097, and as specified herein, the more stringent requirement to govern.

.6 Tanks:

.1 Filament-wound or contact molded construction.

.2 Design safety factor and minimum wall thickness per governing standards.

.3 Sufficient resin on all surfaces to prevent fiber show.

.4 Ends fabricated integrally with shell or separately and laminated to shell.

.5 Joints made with heavy reinforced lay-ups for structural stability and to prevent leakage.

.6 Inner surface layer:

.1 10-20 mils thick.

.2 Inner layer followed by laminate 80-90 mils thick, reinforced with noncontinuous chopped strand fiberglass.

.3 Total thickness of two layers at least 100 mils.

.4 Sufficient resin content per ASTM standard.

.7 Walls structurally reinforced with fiberglass mat or woven roving or with filament winding of continuous strands.

.1 Thickness and glass content of outer wall per tensile and flexural requirements.

.2 Sufficient resin content per ASTM standard.

.8 Reinforcing ribs per manufacturer's recommendations.

.9 Lifting lugs provided on tank.

.10 Coated with protective gel, color as selected.

.11 Minimum wall thickness: 1/4 IN.

.12 Insulation

.1 50mm Polyurethane Foam

.2 3mm FRP Protective Skin

.13 Heat Tracing

.1 Electric Heat Traced Shell

.2 Heat Tracing Control Element – RTD Type

.3 Sufficient for 25DegC temperature control in 10DegC room

.7 Tie Down Lugs: Number and strength required per design loading.

.8 Allowable Surface Tolerances:

.1 Cracks: None.

.2 Crazing (fine surface cracks): None.

.3 Blisters: None.

.4 Wrinkles: Maximum deviation: 10 PCT of wall thickness, but not exceeding 1/8 IN.

.5 Pits: Maximum dimension: 1/8 IN DIA x 1/32 IN deep, maximum number: 10/SQFT.

.6 Surface porosity: None.

.7 Chips: None.

.8 Dry spot: None.

.9 Entrapped air (bubbles or voids in the laminate):

.1 Maximum diameter: 1/16 IN.

.2 Maximum density: 10/SQ IN but none to a depth of 1/32 IN.

.10 Exposed glass: None.

.11 Burned areas: None.

.12 Exposure of cut edges: None.

.13 Scratches: None.

.14 Foreign matter: None.

.9 Certification Label:

.1 ASTM D2563 Level II Certified.

3. EXECUTION

3.1 INSTALLATION

.1 Coordinate with General Contractor for installation of the tank.

END OF SECTION

SECTION 46 33 46
PUMPING EQUIPMENT - PERISTALTIC PUMPS

1. GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Peristaltic metering pumps for caustic soda including:

.1 A factory assembled duplex metering pump skid system including a plastic floor mounted skid.

.2 Chemical accessories including: piping, valves, calibration columns, injection quills and other equipment and instrumentation required for a functional chemical system as shown on Drawings.

.2 Equipment Numbers

.1 CP-033A

.2 CP-034A

.2 Related Sections include but are not necessarily limited to:

.1 Division 1 – General Requirements

.2 Section 01 33 00 – Submittals

.3 Section 01 78 39 – Operation and Maintenance Manuals.

.4 Section 01 61 03 – Equipment: Basic Requirements

.5 Section 43 21 00 – Pumping Equipment: Basic Requirements

.6 Section 40 05 00 – Piping and Pipe Fittings: Basic Requirements

.7 Section 40 05 31 – Pipe: Plastic

.8 Section 40 05 66 – Check Valves

.9 Section 40 05 52 – Miscellaneous Valves

.10 Division 13 – Special Construction

.11 Section 26 05 00 – Electrical: Basic Requirements

1.2 QUALITY ASSURANCE

.1 Referenced Standards:

.1 American Bearing Manufacturers Association (ABMA).

.2 American Gear Manufacturers Association (AGMA).

.3 American Iron and Steel Institute (AISI):

.1 Steel Products Manual.

.4 American National Standards Institute (ANSI).

.5 American Society for Testing Materials (ASTM):

.1 A48, Standard Specification for Gray Iron Castings.

.2 A536, Standard Specification for Ductile Iron Castings.

.3 A666, Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar for Structural Applications.

.6 National Sanitation Foundation (NSF) – NSF-61

.7 Canadian Electrical Code (CEC)

.2 Manufacturer's Experience:

.1 All equipment described under this Section shall be supplied by a manufacturer who has been regularly engaged in the design, manufacture, and installation of the type of equipment specified herein for at least five years. All like equipment to be supplied in multiples units (i.e., metering pumps, valves, gauges, etc.) shall be of a single supplier.

.3 Warranty

.1 The chemical metering pump manufacturer shall provide a two-year warranty on the metering pump mechanical drive and two-year warranty on the liquid end.

.4 System Responsibility:

.1 Pump manufacturer must provide pumps, gear reducers, motors, drives, leak detection systems and pressure gauges/switches and other accessories as specified herein, regardless of manufacturer, as a complete integrated package to ensure proper coordination and compatibility.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 See Section 01 33 00.

.2 Certifications and testing.

.2 Operation and Maintenance Manuals:

.1 See Section 01 78 39.

.3 Catalog data and information including:

.1 Type of liquid handled.

.2 Capacity, gph; maximum and minimum gph.

.3 Motor and adjustable speed drive type.

.4 Materials of construction.

.5 Net positive suction head required.

.6 Manufacturer's catalog data on all accessories including pressure relief valves, pressure regulating valves, pulsation dampeners, flow calibration chambers, and suction assemblies. Data shall demonstrate sizing procedure for pulsation dampeners.

.7 Certification:

.1 The Contractor shall obtain written certification from the manufacturer, addressed to the Owner, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with these specifications and as indicated on the drawings, that all the materials are best suited for the chemicals handled, and that the manufacturer accepts joint responsibility with the Contractor for coordination of all equipment, including motors, variable speed drives, controls, and services required for proper installation and operation of the completely assembled and installed unit. The Contractor shall submit all such certificates to the Engineer.

.8 Tools:

.1 Special tools necessary for maintenance and repair of the equipment shall be furnished as a part of the Work hereunder; such tools shall be suitably stored in metal toolboxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

.9 Maintenance:

.1 Printed instructions related to proper maintenance, including lubrication, and parts lists indicating the various parts by name, number, and diagram where necessary, shall be furnished in duplicate with each unit or set of identical units. A recommended spare parts list shall be included.

.10 Field Procedures:

.1 Instructions for field procedures for erection, adjustments, inspections, and testing shall be provided prior to installation of the equipment.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

.1 Peristaltic Metering Pumps.

.1 Blue-White M3-Series.

.2 Watson Marlow

.2 Injection Quill

.1 Saf-T-Flo Model.

.2 Or approved equal.

2.2 DESIGN CRITERIA

.1 The package chemical feed system will be used to dose 50% sodium hydroxide into the drinking water system.

.2 The system and injection point are located within the new P291 Pump Station. The chemical feed system will inject 2-30 L/hr sodium hydroxide into a sidestream flow at approximately 150 kPa. The sidestream flow will then be injected into the P279 clearwell supply.

.3 The pumping system and all piping and appurtenances on the discharge of the dosing pump up to the injection location are to be rated for 1034 kPa (150 psi).

.4 All materials are to be compatible with 50% sodium hydroxide.

.5 Pumps control and monitoring will be from the local facility PLC and shall include:

.1 PLC controlled flow-proportional operation.

.2 The pumps will each start/stop from individual facility PLC contact closure.

.3 Speed from individual PLC 4-20 mA analog speed signal from the facility PLC.

.6 The pumps will provide individual pump status dry contacts to the facility PLC including:

.1 General Error.

.2 TFD (tube failure detection).

.3 Remote/local.

.4 Pump run/stop.

.7 The Contractor shall consult and follow all safety procedures with regard to handling of 50% sodium hydroxide.

2.3 PERISTALTIC DOSING PUMPS

.1 The units shall be self-priming peristaltic pumps.

.2 Pumps shall:

.1 Be rated for a maximum working pressure of 1034 kPa (150 psi)

.2 Have a maximum suction lift of 9.1 m (30 ft)

.3 Have a motor speed adjustable turndown of 10,000:1

.4 Be rated for a continuous duty cycle

.3 Pump shall have a revolution count down display with a programmable alarm setpoint for tube maintenance and a tube failure detection system.

.4 Pump shall have a multi-colour backlit LCD screen to display remote/local control status, motor speed, output rate, input signal values, service and alarm statuses in three easy to see colours.

.5 Keypad shall be provided for pump manual operation and programming.

.6 Tubing:

.1 Tubing provided under this section shall be compatible (i.e., rated “excellent” or “no effect, little noticeable change or action”) with the chemical pumped.

.7 Pump control and monitoring:

.1 Pump operation shall be enabled via the closure of a remote contact.

.2 The pumping capacity shall vary in proportion to a 4-20 mA analog control signal.

.3 Units shall have one relay output and three programmable dry contacts to be used for status monitoring. Relay and dry contacts to be programmed for:

.1 Relay: General Error

.2 Contact #1: TFD (tube failure detection)

.3 Contact #2: Remote/local

.4 Contact #3: Pump run/stop

.4 Units shall have one programmable 4-20 mA programmable signal which is proportional to pump output.

.8 All wetted components to be compatible with 50% sodium hydroxide.

.9 TDF ystem sensors shall be Hastelloy C-276.

.10 Non-wetted components shall include:

.1 NEMA 4X (IP66) polyester powder coated aluminum enclosure.

.2 Valox thermoplastic pump head and a clear acrylic pump head cover.

.3 Roller assembly shall include a valox rotor, nylon rollers and SS ball bearings.

.4 Chrome plated steel motor shaft.

.5 Stainless steel cover screws.

.11 Pump shall be listed to ANSI/NSF61.

.12 Power supply to be 120V, single phase.

.13 Motor shall be brushless DC type.

.14 Basis of design metering pump:

.1 Blue-White Industries Flex-Pro M3 Metering Pumps.

.2 Approved alternate: Watson-Marlow.

2.4 PUMP PACKAGE

.1 Each pump package shall be pre-configured as follows:

.1 The system shall include two duty peristaltic metering pumps.

.2 Chemical resistant polyethylene floor mounted skid.

.3 One pressure relief valve

.4 Two check valves

.5 One visual flow indicator

.6 One inlet strainer on the common supply line

.7 One calibration column with maximum 60s capacity at maximum pump flowrate. To be located on the on the pump suction lines.

.8 One pulsation dampener

.9 One pressure gauge and diaphragm seal

.10 NPT tubing connections

.11 Schedule 80 PVC piping

.12 Isolation ball valves provided as required

.13 User interface display/keypad shall be front accessible.

.14 The assembled package shall be factory tested prior to shipment.

.15 Three sets of spare tube shall be provided for each pump.

.16 Shall be Pro-Series Chem-Feed Engineered Skid System, with Flex-Pro M-3 metering pumps by Blue-White Industries as supplied by Centrix or approved alternate from Watson-Marlow.

.2 All wetted components to be compatible with 50% sodium hydroxide.

2.5 ACCESSORIES

.1 Provide the following for each peristaltic metering pump:

.1 Pump Control Panel.

.1 Refer to section 2.5.1.3.

.2 Nameplate:

.1 Each piece of equipment shall be equipped with a nameplate, indicating equipment characteristics, capacity, motor horsepower, speed, electrical characteristics, manufacturer, model number, and serial number.

.3 Safety Equipment:

.1 Where required by Code, all chemical uploading, storage, and feeding equipment shall be furnished with the necessary safety devices and warning signs, clearly visible.

.4 Valves:

.1 Degassing Valves:

.1 Provide Plast-o-matic degassing valves on all high points in chemical piping. Provide also on SHC systems anywhere there are two isolation valves in series.

.5 Chemical Injection Quill: Provide as indicated on drawings.

.1 Caustic Carrier Water Injection

.1 2 IN NPT chemical piping connection.

.2 2 IN NPT main connection.

.3 Stainless steel restraint hook and chain.

.4 Brass solution tube adapter and corporation stop.

.5 1 IN Schedule 80 CPVC solution tube, extended a minimum of 3 IN into process piping.

.6 Standard tip configuration with spring loaded ball check valve.

.7 Rated to 150 psig.

.8 Included with hose section to allow removal of injector from injection port.

.2 Caustic to Carrier Water

.1 2 IN 150 LB Flange connection to 2 IN dilution water.

.2 ½ IN Tube size with ½ IN Thread connection

.1 Stainless steel 316SS solution tube, extended a minimum of 0.5 IN into dilution piping.

.3 Standard tip configuration

.4 Rated to 150 PSIG.

.5 Saf-T-Flow CFT Series, or equal

2.6 MAINTENANCE MATERIALS

.1 Peristaltic Metering Pumps:

.1 Tubing:

.1 Five (5) tubing elements of each size and material used on the project.

.2 Chemical injection quill.

.1 Provide one spare chemical injection quill for each one installed.

3. EXECUTION

3.1 INSTALLATION

.1 Pumping equipment shall be installed in accordance with approved procedures submitted with the shop drawings and as shown, unless otherwise approved.

3.2 FIELD QUALITY CONTROL

.1 Comply with Section 43 21 00.

.2 Install per manufacturer's installation instructions.

.3 Coordinate manufacturer's field services.

3.3 SERVICES OF MANUFACTURER

.1 See Section 01 75 00.

.2 Inspection, Startup, and Field Adjustment:

.1 The service representative of the Manufacturer shall be present at each site for one (1) work day for field inspection and one (1) work day for startup and one (1) work day for field adjustment services.

.3 Instruction of Owner's Personnel:

.1 After the equipment has been installed, tested, adjusted, placed in satisfactory operating condition, the pump manufacturer shall provide a minimum of one (1) actual working man-day to instruct the operating personnel in the use and maintenance of the equipment.

END OF SECTION

REFERENCE DOCUMENTS

Contract Drawings For

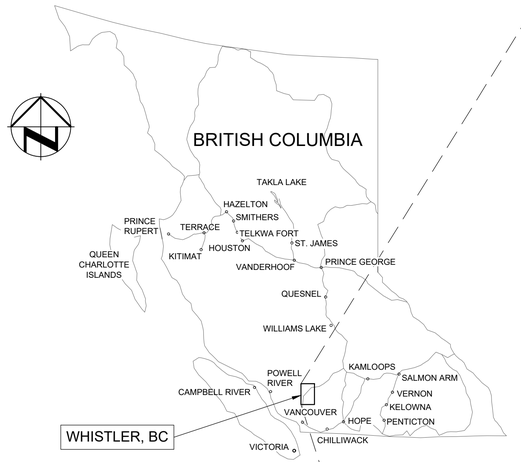
RESORT MUNICIPALITY OF WHISTLER
SOUTH WHISTLER WATER SUPPLY PHASE 1

WHISTLER, BC

REVISION #3

Project No. E20307

Date: JUNE 15, 2023



LOCATION PLAN

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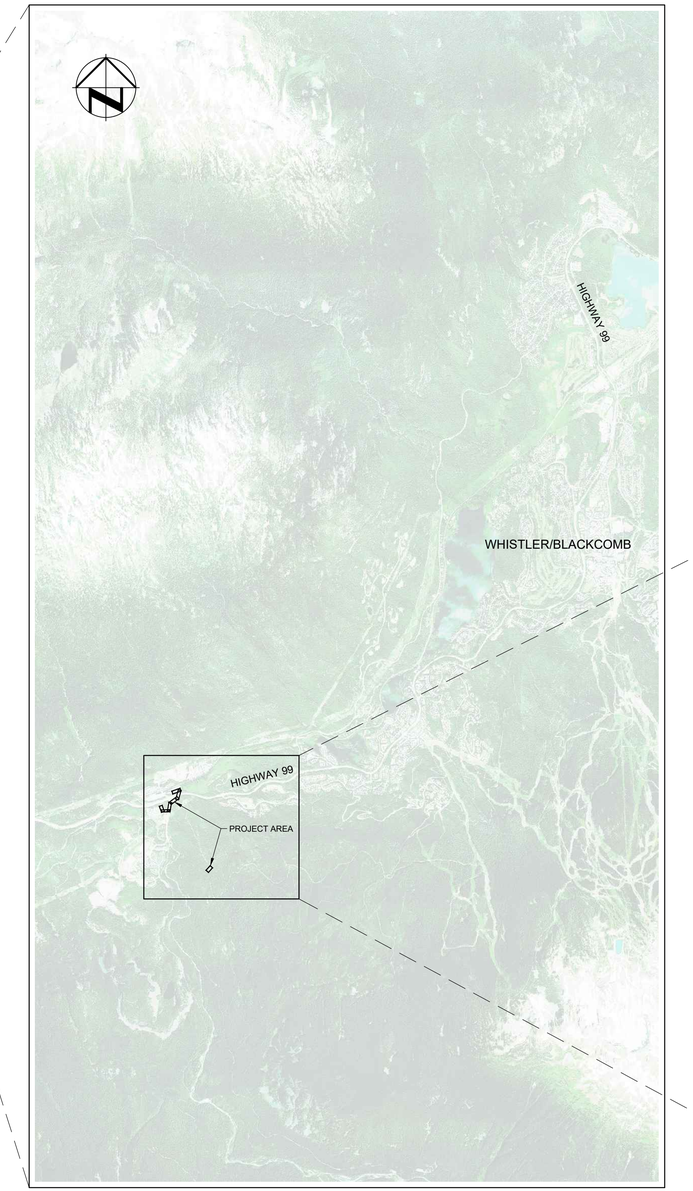

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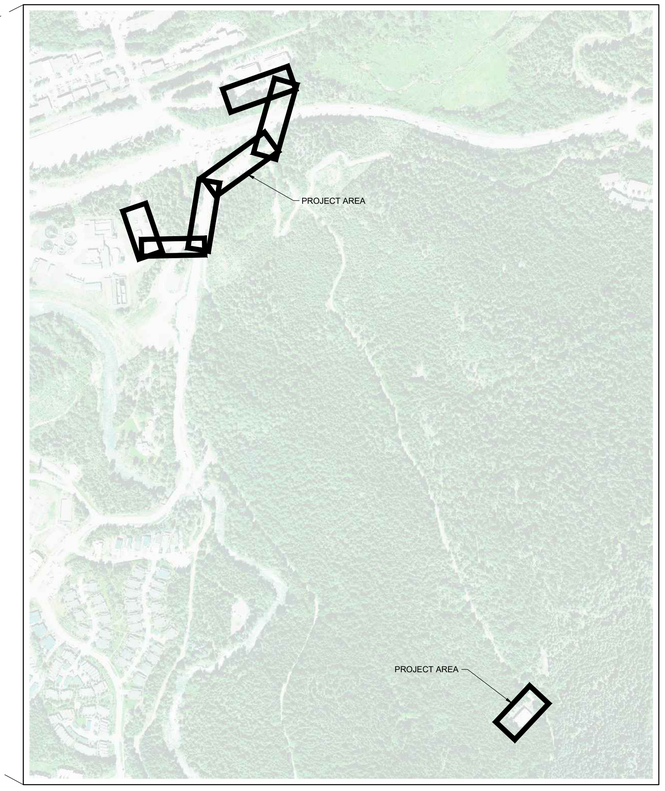

OVERALL PLAN

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4	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
3	2023-05-12	ISSUED FOR CONSTRUCTION
2	2023-03-21	ADDENDUM #2
1	2023-02-14	ISSUED FOR TENDER

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER

Whistler, BC

2023

SOUTH WHISTLER WATER SUPPLY PHASE 1

LOCATION & AREA PLANS & DRAWING INDEX

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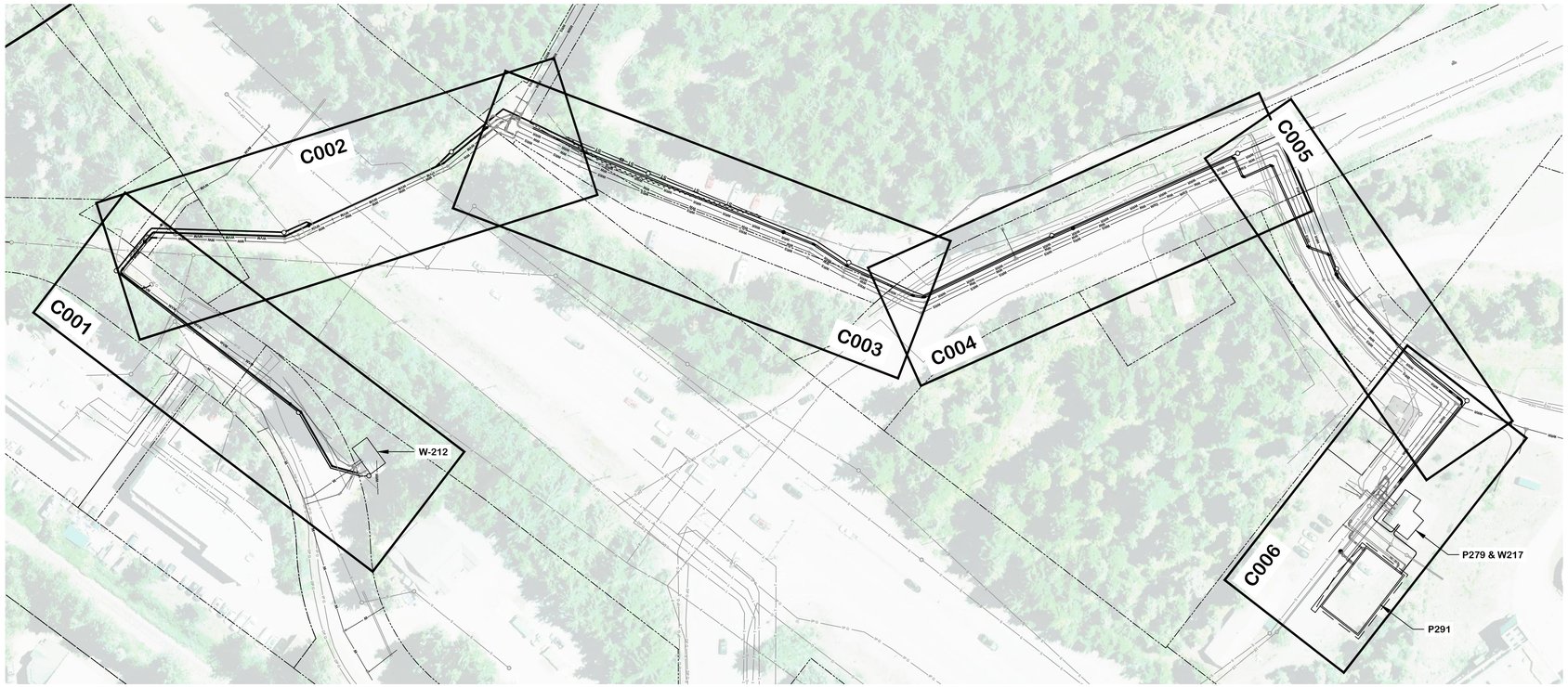

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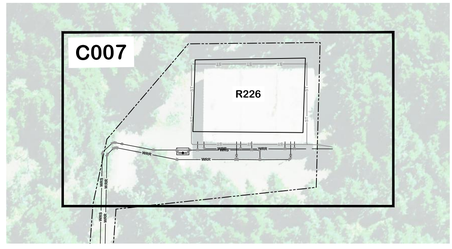

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4	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
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PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

SOUTH WHISTLER
WATER SUPPLY
PHASE 1

2023

SHEET LAYOUT
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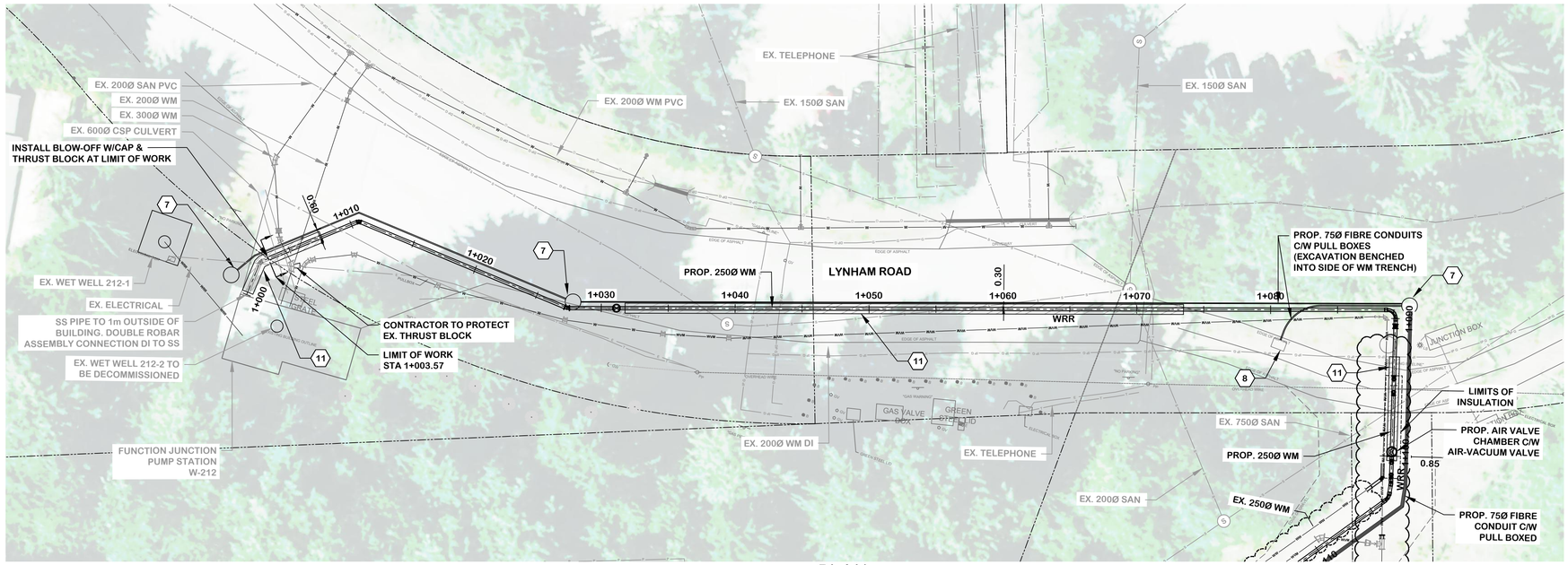

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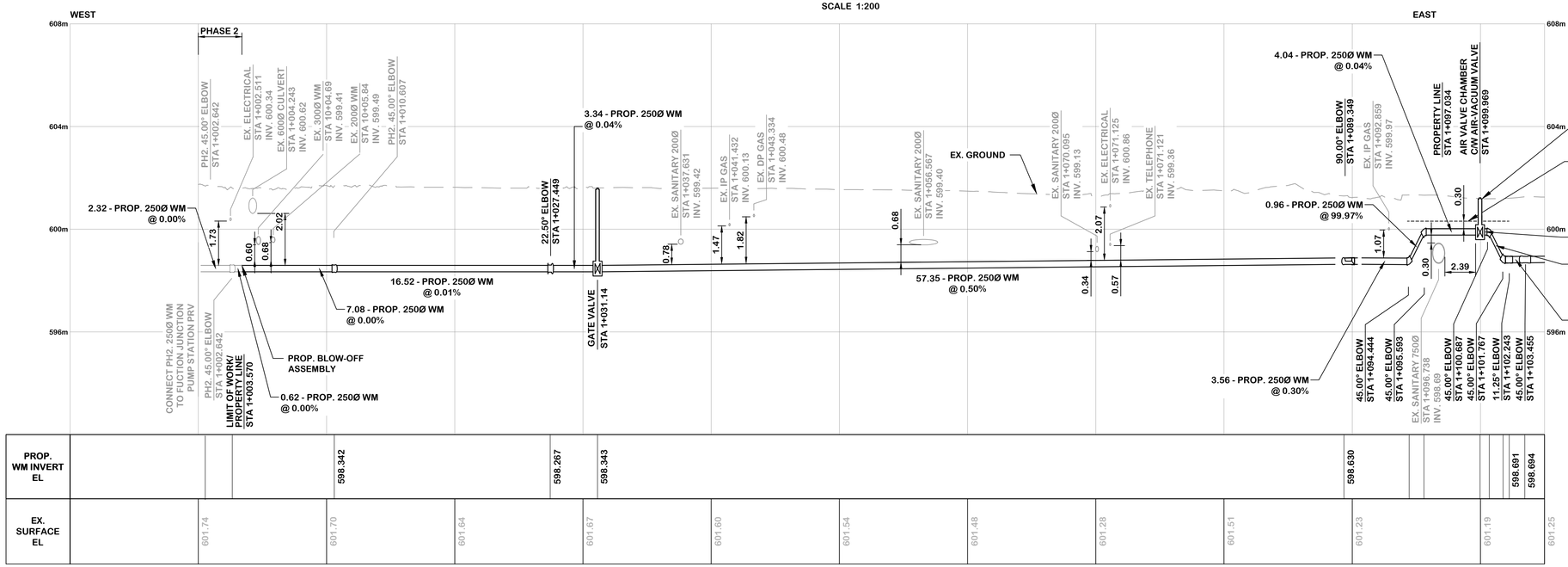

PROFILE

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LEGEND

- PROP. WATERMAIN
- PHASE 2 WATERMAIN
- EX. CHEAKAMUS WATER RESERVOIR RETURN
- EX. CHEAKAMUS WATER RESERVOIR SUPPLY
- EX. VILLAGE MAIN
- EX. WATER WELL WATERMAIN
- EX. WATERMAIN
- EX. WATERMAIN ABANDONED
- EX.ELECTRICAL
- EX. DITCH
- EX. SANITARY SEWER
- EX. TELEPHONE
- EX. STREETLIGHT
- EX. DER ELECTRICAL
- EX. DES ELECTRICAL
- EX. DOM PRESSURE GAS
- EX. INT PRESSURE GAS
- EX. PROPERTY LINE
- LIMIT OF WORK
- EX. PIPE REMOVAL
- PROP. PULL BOX
- PROP. GATE VALVE
- PHASE 2 GATE VALVE
- PROP. AIR VALVE

CONSTRUCTION NOTES:

1. 250Ø PIPES TO BE AWWA C900 PVC DR18 OR AWWA C151 DI WITH CEMENTATIOUS LINING WITH FLEXIBLE RESTRAINED JOINTS, US PIPE TR FLEX OR EQUIVALENT, AND FACTORY SEAL COATED, FIELD INSTALLED IN POLYETHYLENE SHEATH PER AWWA C105.
2. 400Ø PIPES TO BE AWWA C151 DI WITH FLEXIBLE RESTRAINED JOINTS, US PIPE TR FLEX OR EQUIVALENT, AND FACTORY SEAL COATED, FIELD INSTALLED IN POLYETHYLENE SHEATH PER AWWA C105.
3. ALL WATER MAIN JOINTS TO BE WRAPPED WITH PETROLATUM TAPE PER AWWA C217 AND NACE SP0375.
4. EXPOSE PIPE JOINTS AND INSTALL MECHANICAL RESTRAINTS WHERE NOT PRESENT ON APPROX. 65m EXISTING WM.
5. EXPOSE PIPE JOINTS AND INSTALL MECHANICAL RESTRAINTS WHERE NOT PRESENT ON APPROX. 25m EXISTING WW.
6. DB 2 FIBRE CONDUITS TO HAVE PULL BOXES AT MAX 90m THROUGH STRAIGHT SECTIONS AND MAX 60m THROUGH BENDS TOTALING UP TO 180°.
7. 1.2m FIBRE PULL BOX PER DETAIL E, DWG C010.
8. EX. 5686 FIBRE PULL BOX PER DETAIL G, DWG C011 (LOCATION APPROXIMATE).
9. FIBRE CONDUITS TO HAVE PULL STRINGS INSTALLED.
10. ALL EXISTING UTILITY LOCATIONS TO BE VERIFIED IN FIELD BY CONTRACTOR PRIOR TO CONSTRUCTION.
11. EXTENT OF HYDRAULIC PROTECTION AS PER DETAIL H ON C010 (TYP.)

GENERAL NOTES:

1. DRAWINGS ARE IN REFERENCE TO NAD83 UTM10N COORDINATE SYSTEM.
2. COMBINED SCALE FACTOR: 0.9997083.

ISSUE	DATE	DESCRIPTION
8	2023-07-06	ISSUED FOR CONSTRUCTION REV 5
7	2023-06-28	ISSUED FOR CONSTRUCTION REV 4
6	2023-06-15	ISSUED FOR CONSTRUCTION REV 3
5	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
4	2023-05-12	ISSUED FOR CONSTRUCTION
3	2023-04-11	POST-TENDER MODIFICATIONS
2	2023-03-21	ADDENDUM #2

PROJECT MANAGER	M. DAY
CIVIL	-
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

LYNHAM ROAD

PLAN AND PROFILE

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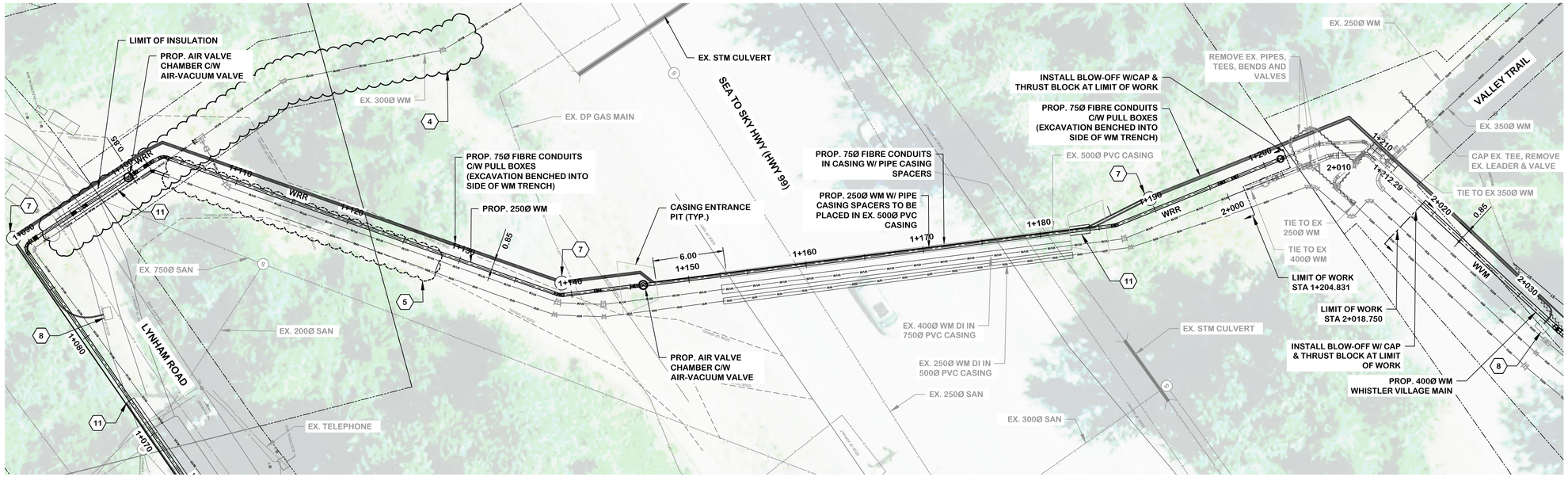

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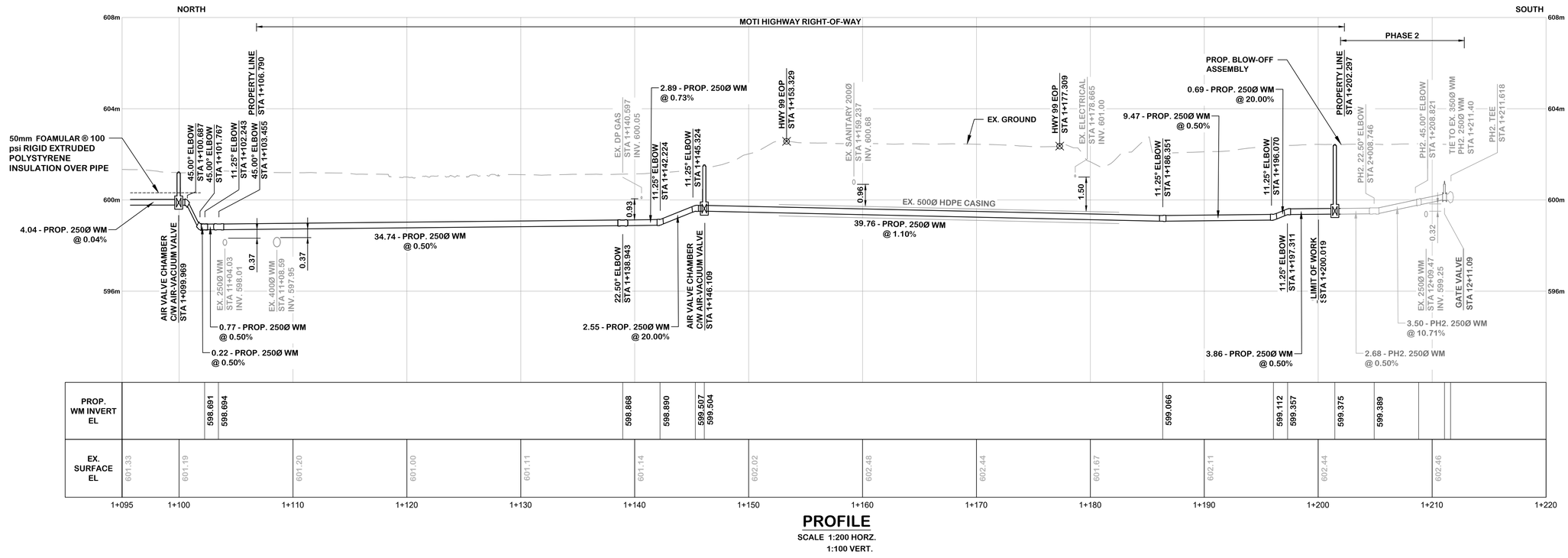

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LEGEND

- PROP. WATERMAIN
- PHASE 2 WATERMAIN
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- PROP. GATE VALVE
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CONSTRUCTION NOTES:

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GENERAL NOTES:

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2. COMBINED SCALE FACTOR: 0.9997083.

ISSUE	DATE	DESCRIPTION
8	2023-07-06	ISSUED FOR CONSTRUCTION REV 5
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PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

HWY 99 CROSSING

PLAN AND PROFILE

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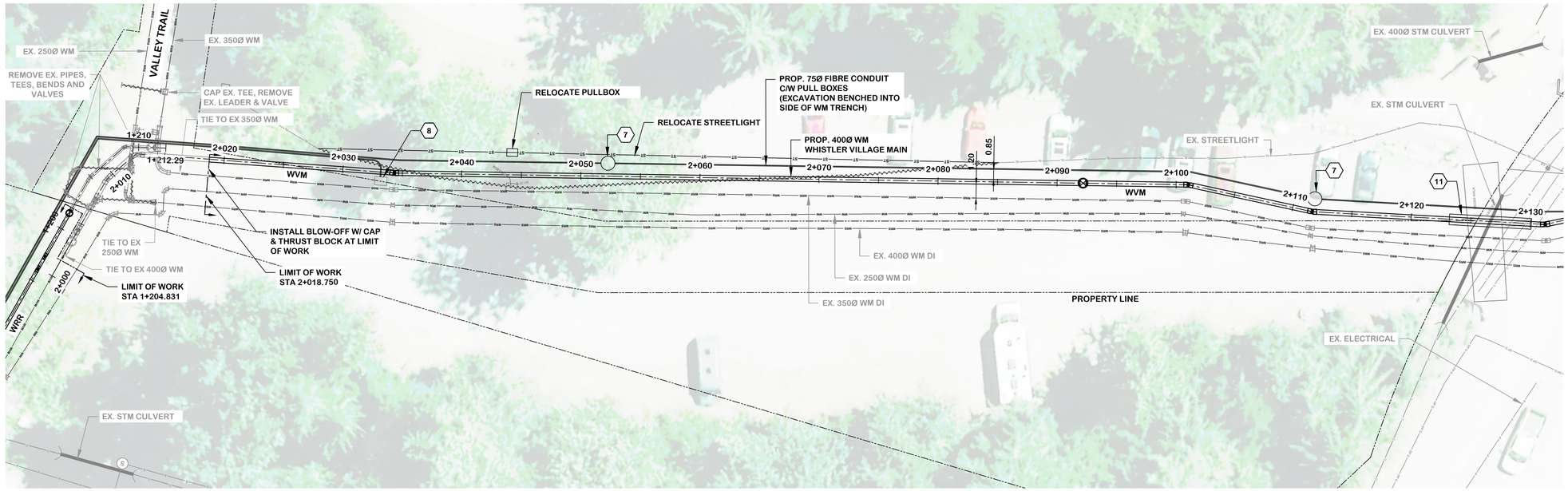

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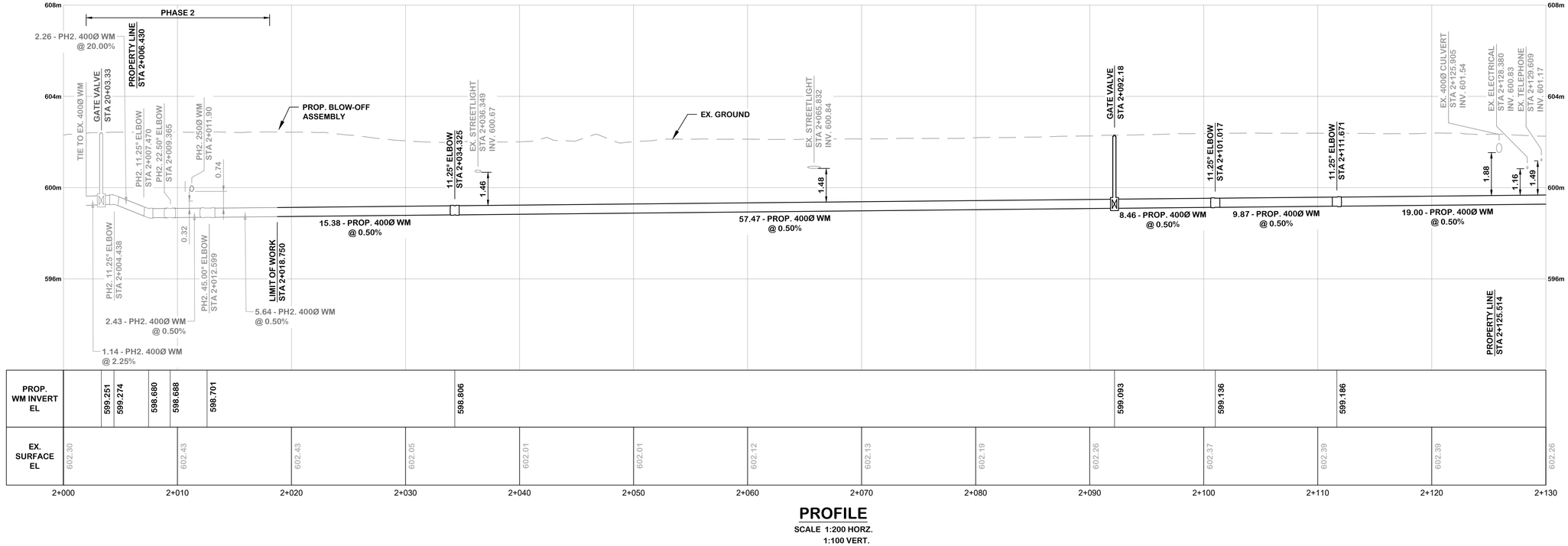

PROFILE

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LEGEND

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- EX. CHEAKAMUS WATER RESERVOIR RETURN
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GENERAL NOTES:

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ISSUE	DATE	DESCRIPTION
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4	2023-05-12	ISSUED FOR CONSTRUCTION
3	2023-04-05	POST-TENDER MODIFICATIONS
2	2023-03-21	ADDENDUM #2
1	2023-02-14	ISSUED FOR TENDER

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

VALLEY TRAIL PARKING LOT

PLAN AND PROFILE

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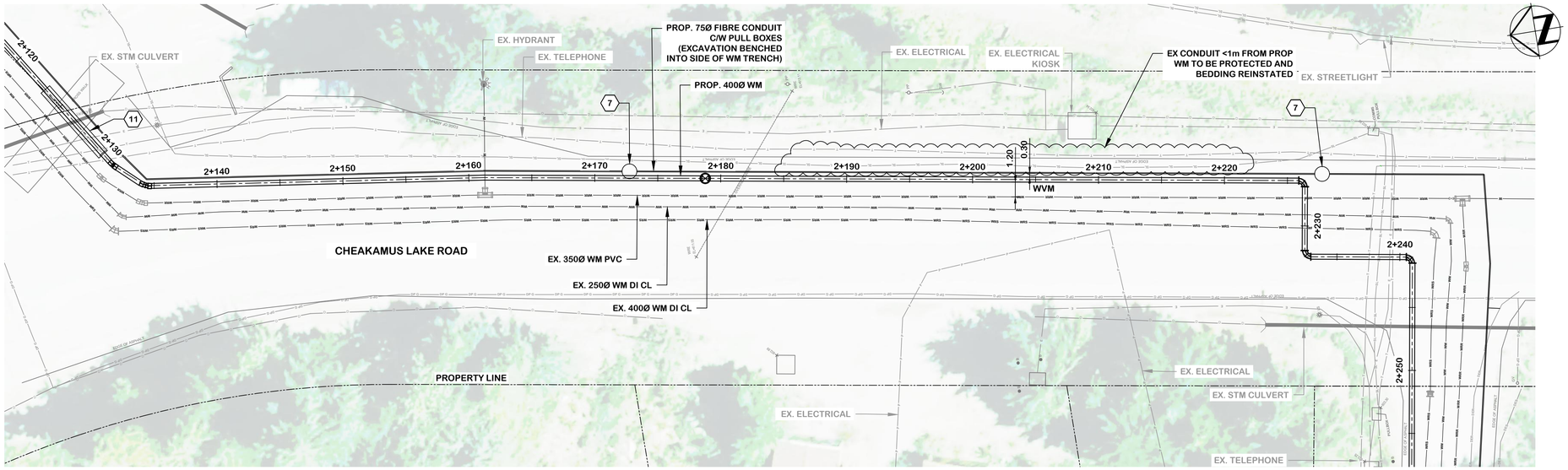

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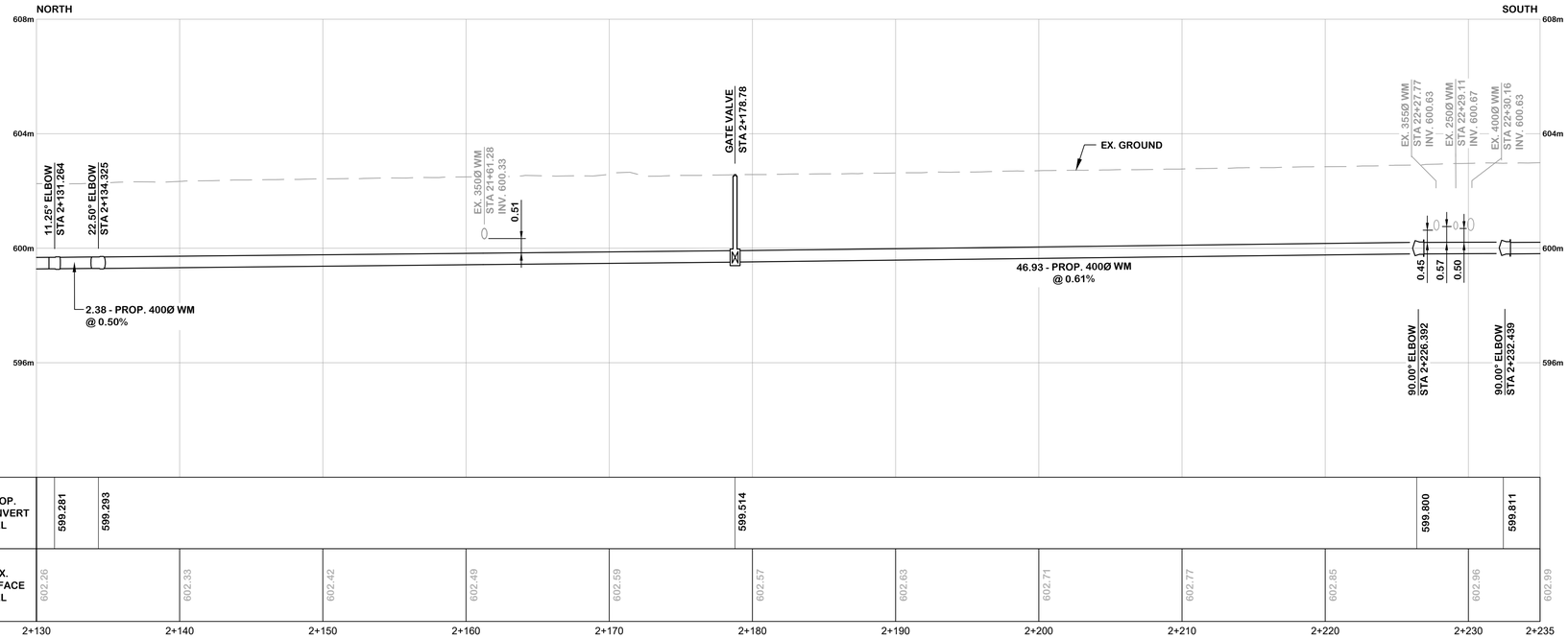

PROFILE

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LEGEND

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- PHASE 2 WATERMAIN
- EX. CHEAKAMUS WATER RESERVOIR RETURN
- EX. CHEAKAMUS WATER RESERVOIR SUPPLY
- EX. VILLAGE MAIN
- EX. WATER WELL WATERMAIN
- EX. WATERMAIN
- EX. WATERMAIN ABANDONED
- EX.ELECTRICAL
- EX. DITCH
- EX. SANITARY SEWER
- EX. TELEPHONE
- EX. STREETLIGHT
- EX. DER ELECTRICAL
- EX. DES ELECTRICAL
- EX. DOM PRESSURE GAS
- EX. INT PRESSURE GAS
- EX. PROPERTY LINE
- LIMIT OF WORK
- EX. PIPE REMOVAL
- PROP. PULL BOX
- PROP. GATE VALVE
- PHASE 2 GATE VALVE
- PROP. AIR VALVE

CONSTRUCTION NOTES:

1. 250Ø PIPES TO BE AWWA C900 PVC DR18 OR AWWA C151 DI WITH CEMENTATIOUS LINING WITH FLEXIBLE RESTRAINED JOINTS, US PIPE TR FLEX OR EQUIVALENT, AND FACTORY SEAL COATED, FIELD INSTALLED IN POLYETHYLENE SHEATH PER AWWA C105.
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8. EX. 5686 FIBRE PULL BOX PER DETAIL G, DWG C011 (LOCATION APPROXIMATE).
9. FIBRE CONDUITS TO HAVE PULL STRINGS INSTALLED.
10. ALL EXISTING UTILITY LOCATIONS TO BE VERIFIED IN FIELD BY CONTRACTOR PRIOR TO CONSTRUCTION.
11. EXTENT OF HYDRAULIC PROTECTION AS PER DETAIL H ON C010 (TYP.)

GENERAL NOTES:

1. DRAWINGS ARE IN REFERENCE TO NAD83 UTM10N COORDINATE SYSTEM.
2. COMBINED SCALE FACTOR: 0.9997083.

ISSUE	DATE	DESCRIPTION
7	2023-08-03	ISSUED FOR CONSTRUCTION REV 6
6	2023-06-15	ISSUED FOR CONSTRUCTION REV 3
5	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
4	2023-05-12	ISSUED FOR CONSTRUCTON
3	2023-04-11	POST-TENDER MODIFICATIONS
2	2023-03-21	ADDENDUM #2
1	2023-02-14	ISSUED FOR TENDER

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY PHASE 1

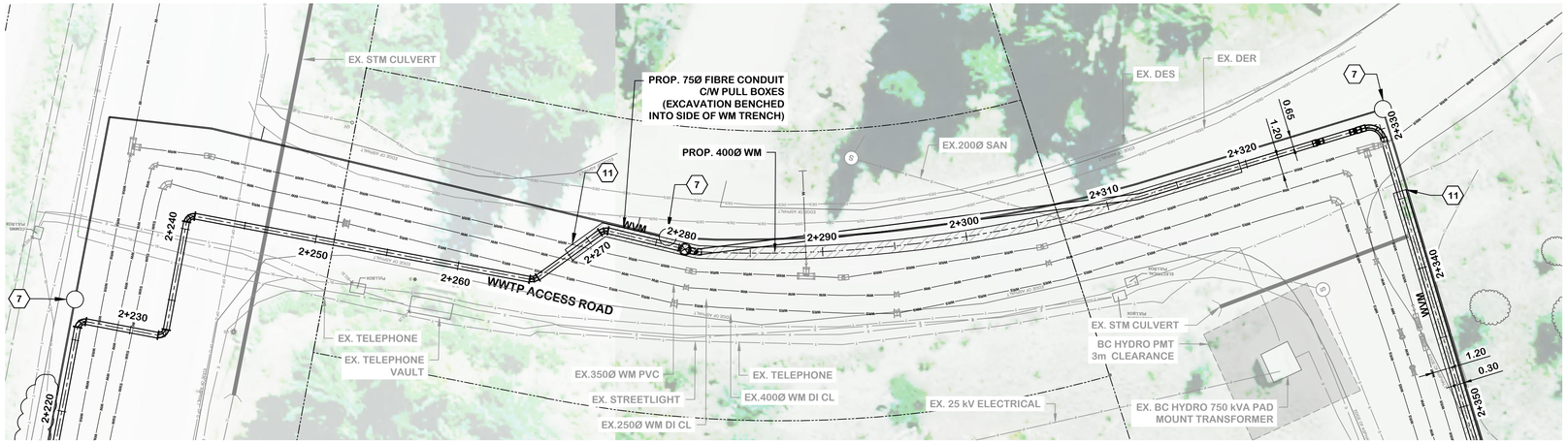
2023

CHEAKAMUS LAKE ROAD

PLAN AND PROFILE

0 5m 10m

FILENAME 10299470-C01-101-C001.dwg
SCALE AS NOTED
SHEET C004



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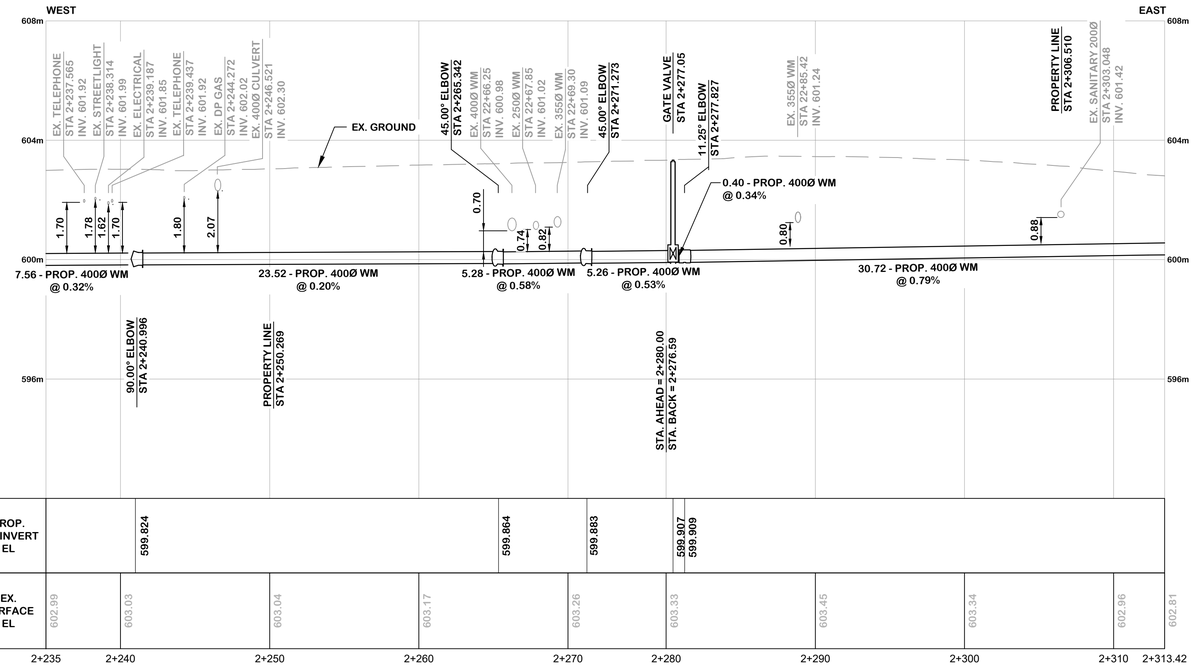

PROFILE
SCALE 1:200 HORZ.
1:100 VERT.

LEGEND

- PROP. WATERMAIN
- PHASE 2 WATERMAIN
- EX. CHEAKAMUS WATER RESERVOIR RETURN
- EX. CHEAKAMUS WATER RESERVOIR SUPPLY
- EX. VILLAGE MAIN
- EX. WATER WELL WATERMAIN
- EX. WATERMAIN
- EX. WATERMAIN ABANDONED
- EX.ELECTRICAL
- EX. DITCH
- EX. SANITARY SEWER
- EX. TELEPHONE
- EX. STREETLIGHT
- EX. DER ELECTRICAL
- EX. DES ELECTRICAL
- EX. DOM PRESSURE GAS
- EX. INT PRESSURE GAS
- EX. PROPERTY LINE
- LIMIT OF WORK
- EX. PIPE REMOVAL
- PROP. PULL BOX
- PROP. GATE VALVE
- PHASE 2 GATE VALVE
- PROP. AIR VALVE

CONSTRUCTION NOTES:

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GENERAL NOTES:

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2. COMBINED SCALE FACTOR: 0.9997083.

ISSUE	DATE	DESCRIPTION
7	2023-08-03	ISSUED FOR CONSTRUCTION REV 6
6	2023-06-15	ISSUED FOR CONSTRUCTION REV 3
5	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
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3	2023-04-11	POST-TENDER MODIFICATIONS
2	2023-03-21	ADDENDUM #2
1	2023-02-14	ISSUED FOR TENDER

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

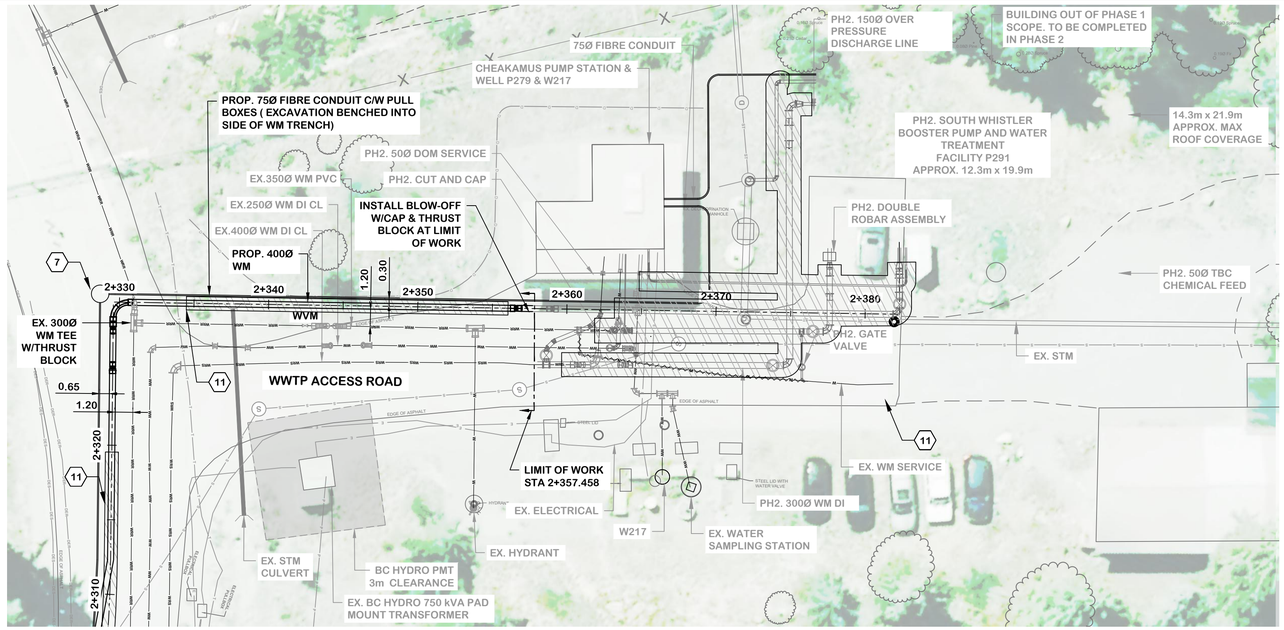
SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

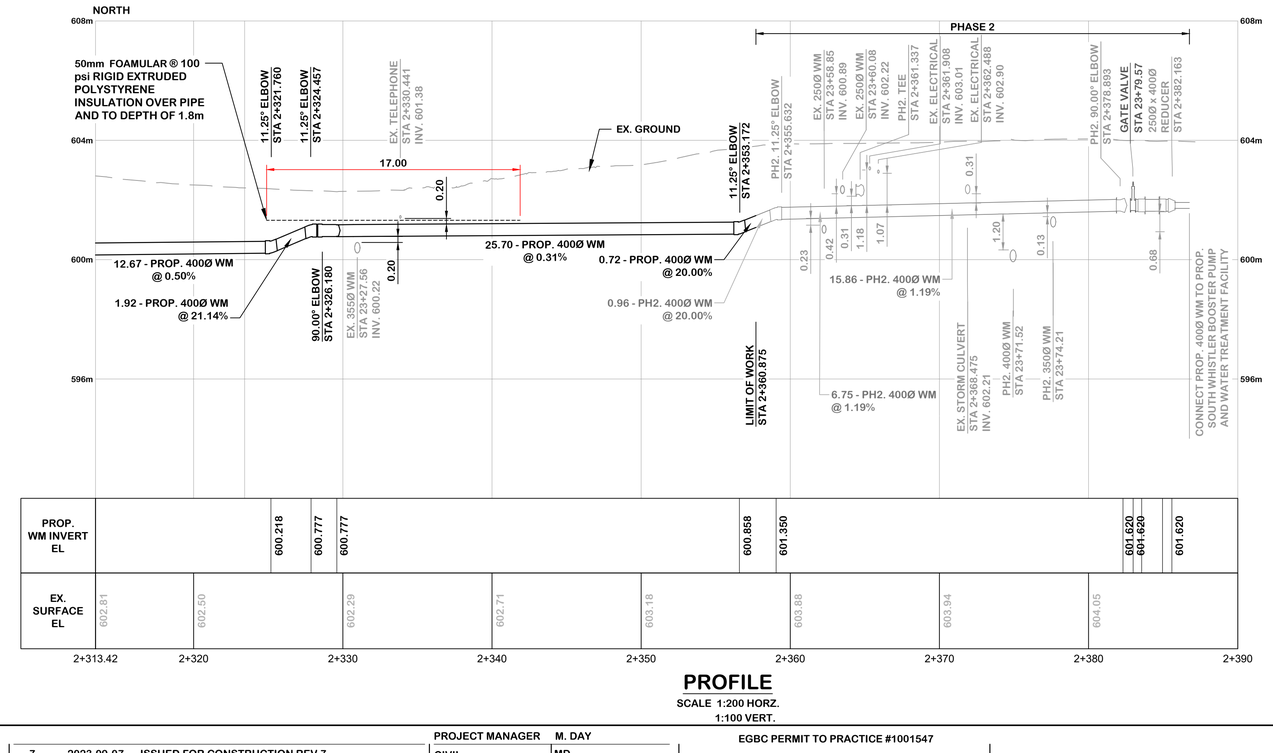
WWTP ACCESS ROAD
PLAN AND PROFILE

0 5m 10m

FILENAME 10299470-C01-101-C001.dwg
SCALE AS NOTED
SHEET C005



PLAN
SCALE 1:200



PROFILE
SCALE 1:200 HORZ.
1:100 VERT.

LEGEND

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- PHASE 2 WATERMAIN
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- EX. CHEAKAMUS WATER RESERVOIR SUPPLY
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2. COMBINED SCALE FACTOR: 0.9997083.

ISSUE	DATE	DESCRIPTION
7	2023-09-07	ISSUED FOR CONSTRUCTION REV 7
6	2023-06-15	ISSUED FOR CONSTRUCTION REV 3
5	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
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1	2023-02-14	ISSUED FOR TENDER

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

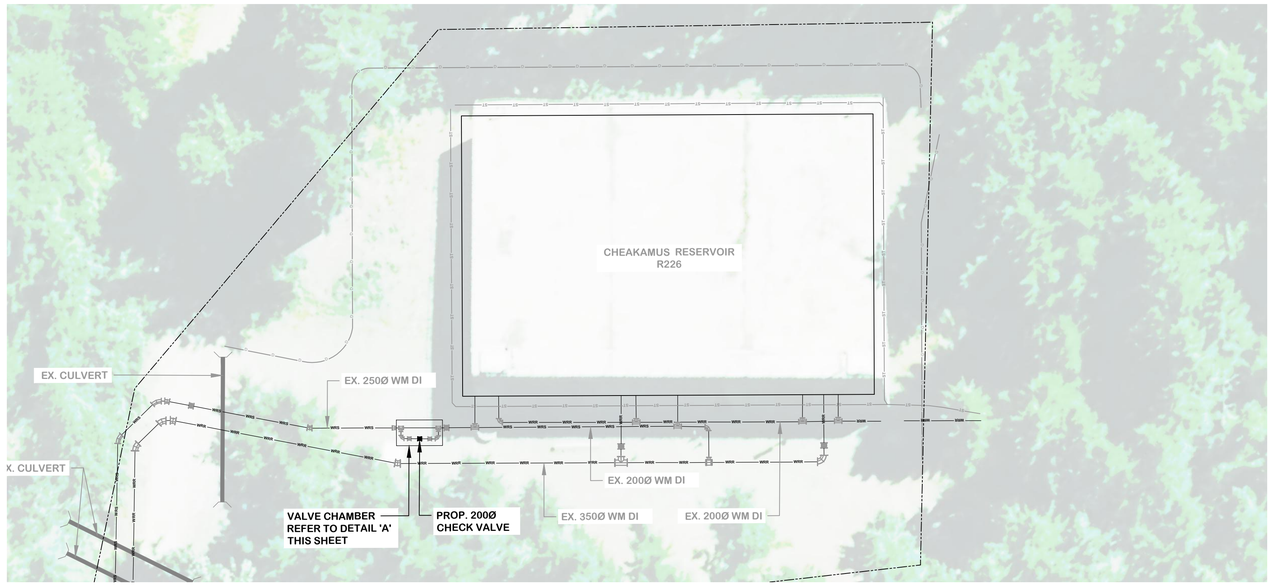
SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

P291 PUMP STATION
PLAN AND PROFILE

0 5m 10m

FILENAME 10299470-C01-101-C001.dwg
SCALE AS NOTED
SHEET C006



PLAN
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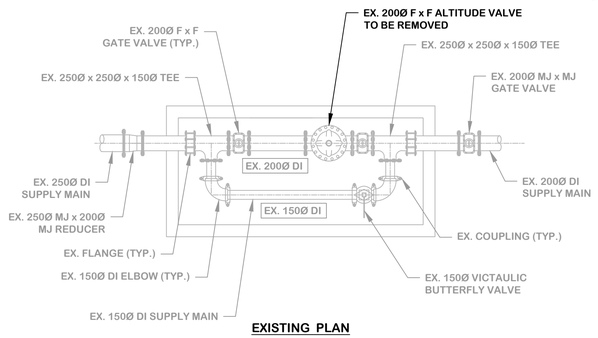
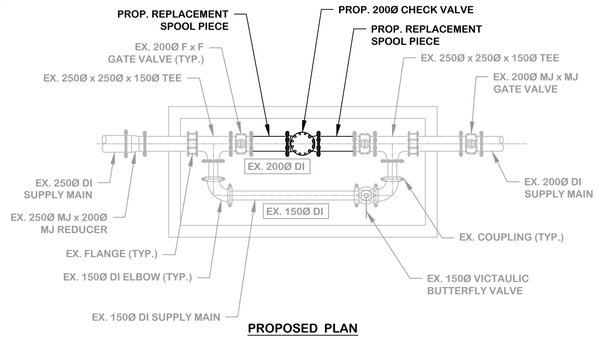
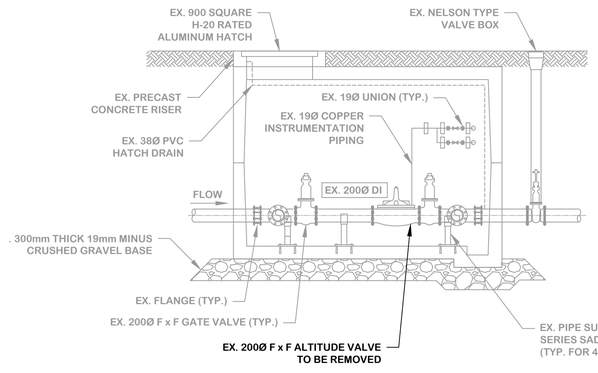


EXISTING PLAN

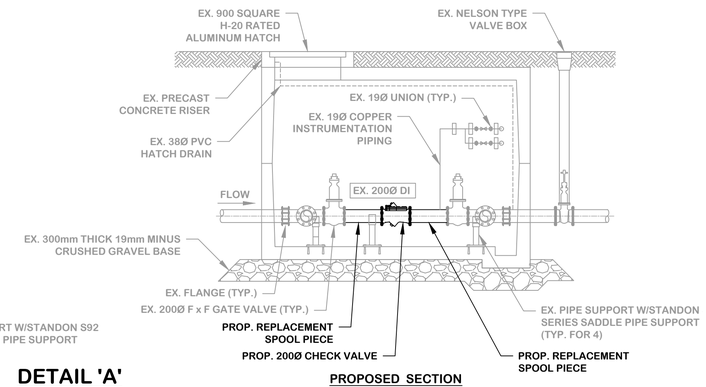


PROPOSED PLAN



EXISTING SECTION

DETAIL 'A'
SCALE NTS



PROPOSED SECTION

LEGEND

- PROP. WATERMAIN
- PHASE 2 WATERMAIN
- EX. CHEAKAMUS WATER RESERVOIR RETURN
- EX. CHEAKAMUS WATER RESERVOIR SUPPLY
- EX. VILLAGE MAIN
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ISSUE	DATE	DESCRIPTION
6	2023-06-15	ISSUED FOR CONSTRUCTION REV 3
5	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
4	2023-05-12	ISSUED FOR CONSTRUCTION
3	2023-04-11	POST-TENDER MODIFICATIONS
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1	2023-02-14	ISSUED FOR TENDER

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

SOUTH WHISTLER
WATER SUPPLY
PHASE 1

2023

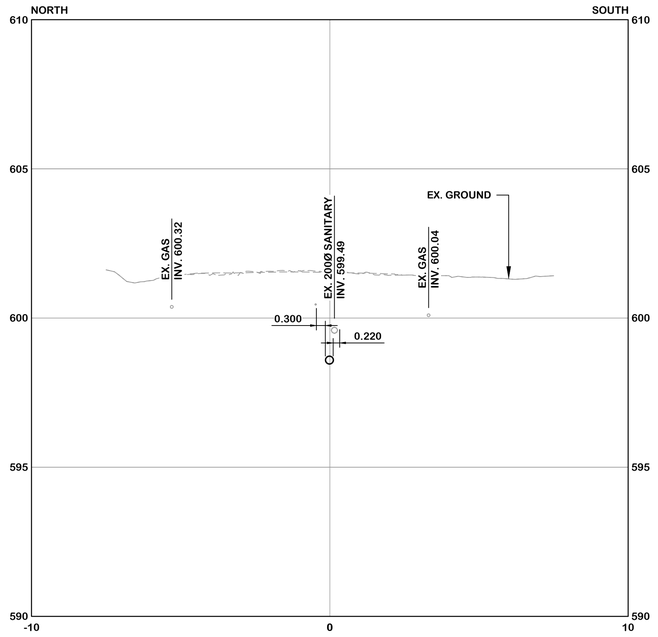
R226 CHEAKAMUS RESERVOIR

PLAN AND PROFILE

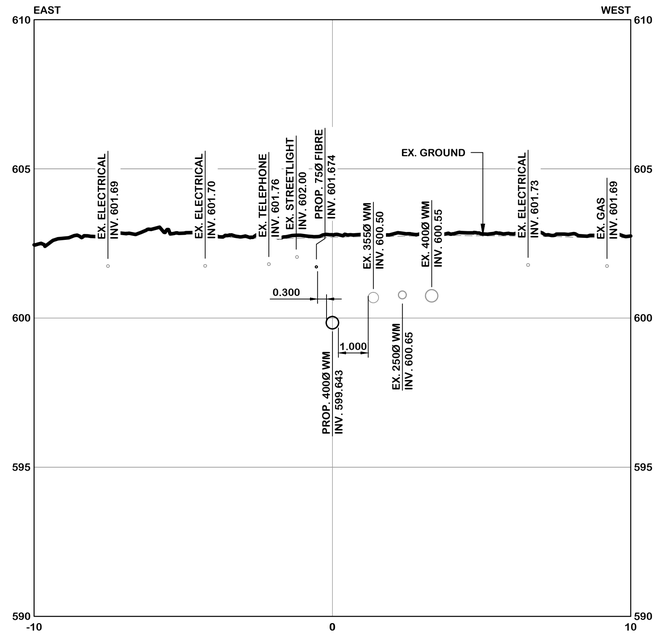
0 5m 10m

FILENAME 10299470-C01-101-C001.dwg
SCALE AS NOTED

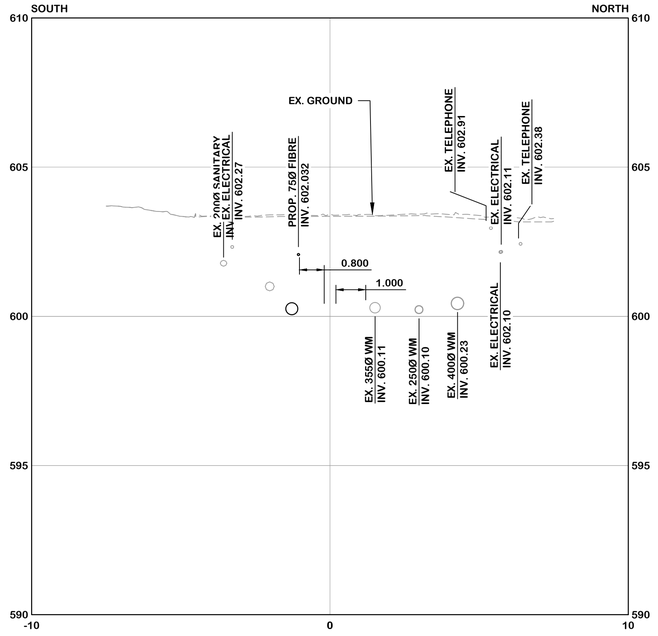
SHEET
C007



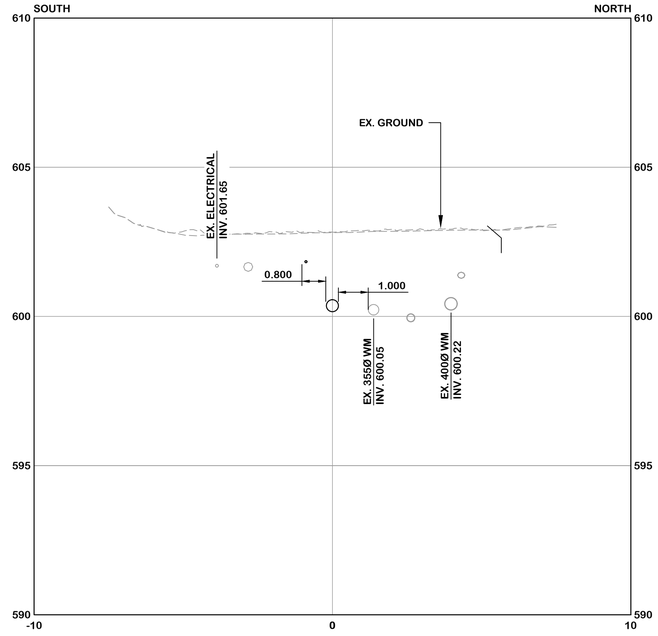
STA 1+055



STA 2+200



STA 2+299.42



STA 2+313.42

ISSUE	DATE	DESCRIPTION
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EGBC PERMIT TO PRACTICE #1001547

WHISTLER

Whistler, BC

SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

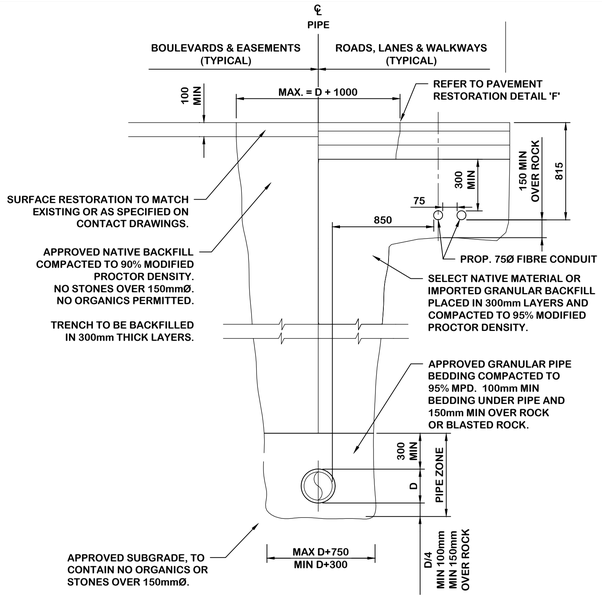
0 2m 4m

DETAIL SECTIONS

FILENAME 10299470-C01-101-C008.dwg

SCALE H 1:100

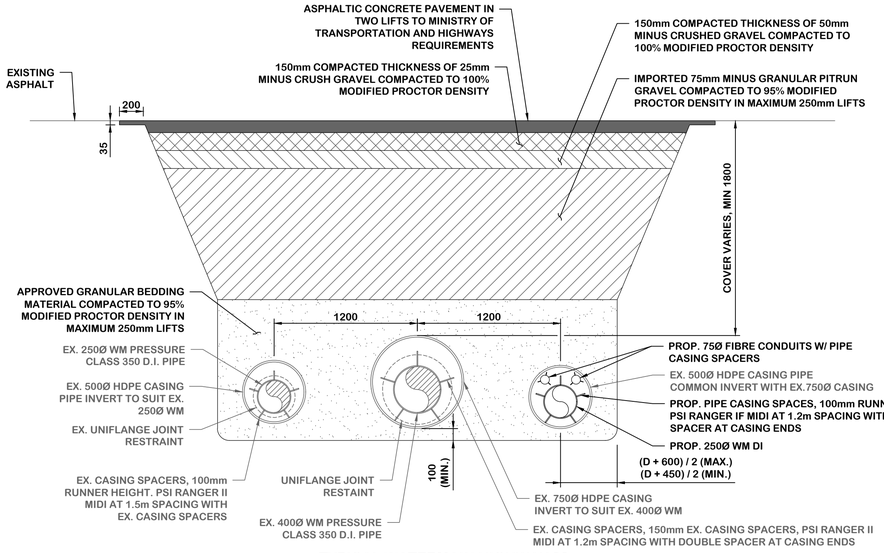
SHEET C008



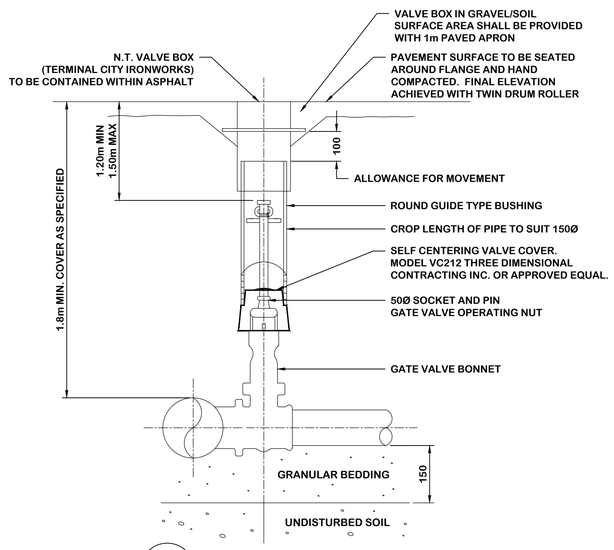
NOTES:
1. "D" = OUTSIDE DIAMETER OF THE PIPE AT ITS LARGEST SECTION.
2. TRENCHING TO COMPLY WITH ALL REQUIREMENTS OF THE WCB.

TRACER WIRE SHALL BE:
1. INSTALLED IN ALL CONDUIT
2. CONTINUOUS BETWEEN ANY TWO SUCCESSIVE COMM VAULT.
3. #13 AWG COPPER CLAD STEEL, HIGH STRENGTH WITH MINIMUM 450LB BREAK LOAD, WITH MINIMUM 30MIL HDPE INSULATION THICKNESS

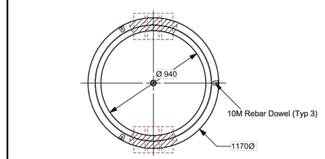
A - TYPICAL TRENCH SECTION
NTS



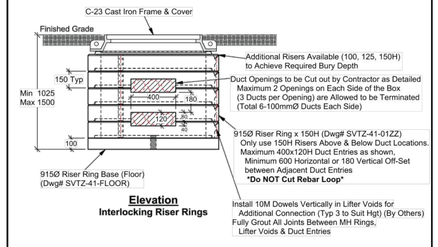
D - TYPICAL WATERMAIN HIGHWAY 99 CROSSING TRENCH DETAIL
NTS



B - VALVE BOX ASSEMBLY
NTS



Plan View



Elevation
Interlocking Riser Rings

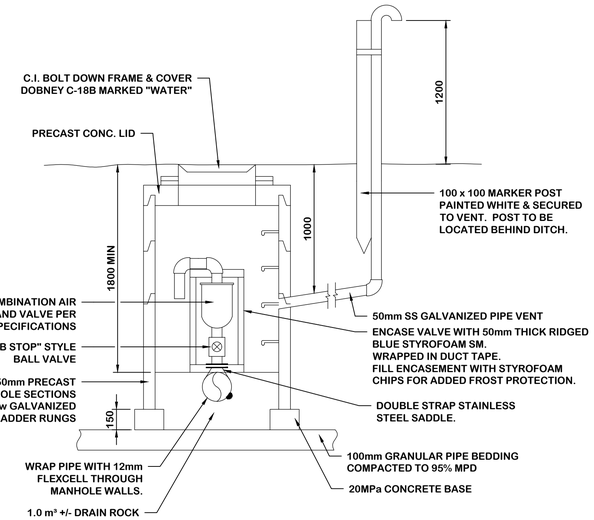
General Notes:
- Product manufactured in accordance with CSA A23.4
- Lift Points Provided (See Shop Drawing for Quantity & Locations)
- Designed for Roadway Traffic Use - CL-625 Traffic Loading
- Site Installation, Backfilling & Suitability for Use is the responsibility of others

AE CONCRETE
19000 - 56th Avenue Surrey, B.C. V3S 8E8
Tel (604) 576-1808 info@aeconcrete.com

Circular Riser Ring Service Box		
915Ø Riser Ring Base (Floor): 720 lbs 915Ø Riser Ring (150H): 300 lbs C-23 Frame & Cover: 560 lbs	Scale: 1:20 mm	Rev:
	Dwg#: SVTZ-N1-0915-SBOX-C	

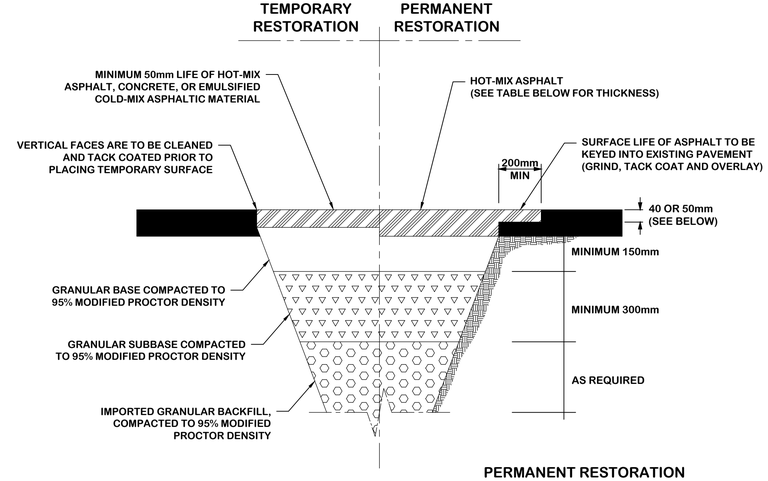
TRACER WIRE:
1. SHALL BE #12 AWG COPPER CLAD STEEL, HIGH STRENGTH WITH MINIMUM 450LB BREAK LOAD, WITH MINIMUM 30 MIL HDPE INSULATION THICKNESS.
2. SHALL BE PULLED INTO AND GROUNDED TO COMM VAULT.
3. ADDITIONAL 300mm OF TRACER WIRE SHALL BE COILED INSIDE COMM VAULT, CAPPED WITH MARETTE AND WRAPPED IN ELECTRICAL TAPE.

E - 1.2m FIBRE PULL BOX
NTS



NOTES:
- ALL "WATER CONTACT" FITTINGS TO BE BRASS OR OTHER APPROVED MATERIAL.
- NO BLACK IRON OR GALVANIZED PIPE OR FITTINGS.
- APPLY AN APPROVED CORROSION PROTECTION SYSTEM TO ALL BURIED FERROUS FITTINGS, FLANGES, FASTENERS, ETC.
  SUCH AS "DENSO" PETROLATUM TAPE SYSTEM; INCLUDING PASTE, PROFILING MASTIC AND TAPE AS PER MANUFACTURER'S INSTRUCTIONS, OTHER CORROSION PROTECTION SYSTEMS MAY BE USED UPON APPROVAL OF THE RMOW.

C - AIR VACUUM RELIEF STATION
NTS



NOTES:
1. GRANULAR MATERIALS TO BE PLACED AND COMPACTED IN MAXIMUM 300mm THICK LIFTS.
2. PERMANENT HOT-MIX ASPHALT PAVEMENT SHALL BE PLACED AND COMPACTED IN 2 LIFTS.
3. ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE PROVISIONS OF THE WORKERS' COMPENSATION ACT OF BC.
4. REFER TO SECTIONS OF 02223 AND 02512 OF THE MATER MUNICIPAL CONSTRUCTION DOCUMENT FOR DETAILED SPECIFICATIONS.

PERMANENT RESTORATION ASPHALT THICKNESS

ROAD CLASSIFICATION	BASE LIFT THICKNESS	SURFACE LIFT THICKNESS
LOCAL ROAD	40mm	40mm
COLLECTOR ROAD	50mm	50mm

F - PAVEMENT RESTORATION
NTS

ISSUE	DATE	DESCRIPTION
6	2023-06-15	ISSUED FOR CONSTRUCTION REV 3
5	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
4	2023-05-12	ISSUED FOR CONSTRUCTION
3	2023-04-11	POST-TENDER MODIFICATIONS
2	2023-03-21	ADDENDUM #2
1	2023-02-14	ISSUED FOR TENDER

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

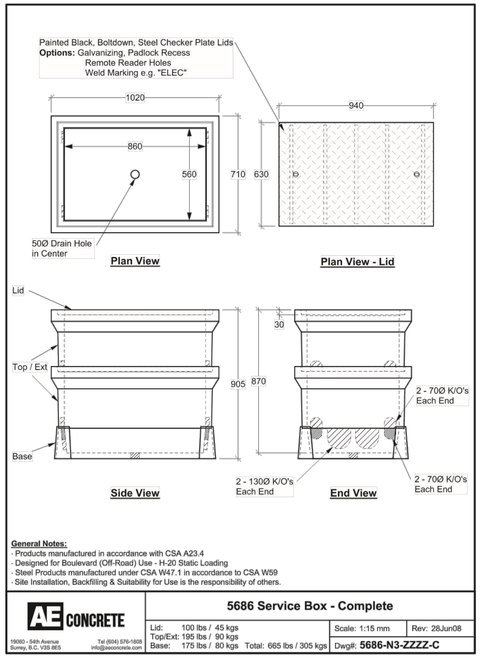
WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

STANDARD DETAILS SHEET 1

FILENAME 10299470-C01-101-C009.dwg
SCALE AS NOTED
SHEET C009



General Notes:
- Products manufactured in accordance with CSA A23.4
- Designed for Boulevard (Off-Road) Use - H-20 Static Loading
- Steel Products manufactured under CSA W47.1 in accordance to CSA W59
- Site Installation, Backfilling & Suitability for Use is the responsibility of others.

AE CONCRETE
19060 - 54th Avenue, Surrey, B.C. V3S 8E5
Tel (604) 576-1808
info@aeconcrete.com

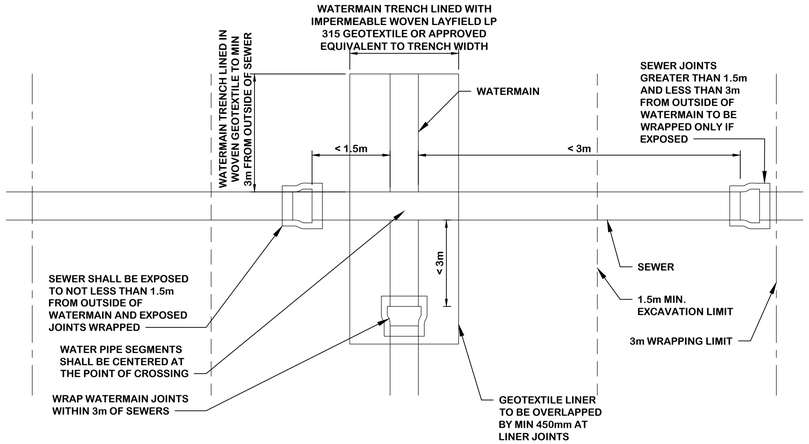
5686 Service Box - Complete

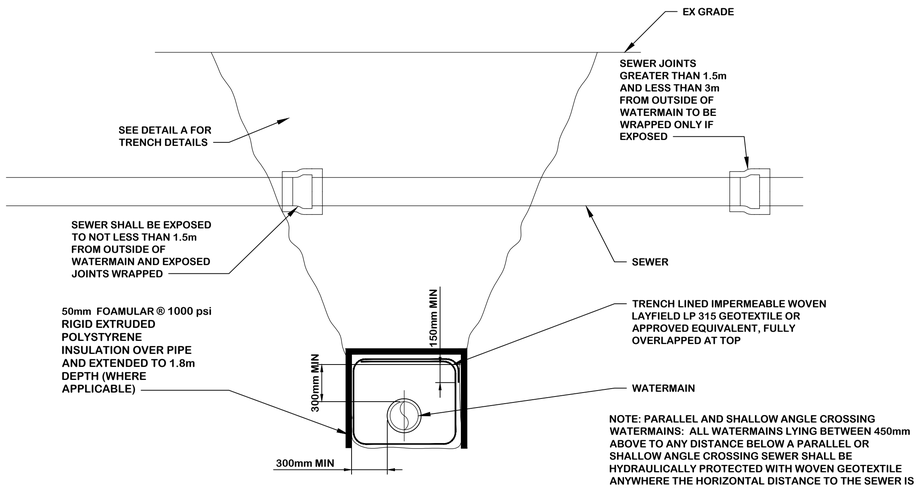
Lid: 100 lbs / 45 kgs
Top/Ext: 195 lbs / 90 kgs
Base: 175 lbs / 80 kgs Total: 665 lbs / 305 kgs

Scale: 1:15 mm | Rev: 28Jun08

Dwg#: **5686-N3-ZZZZ-C**

G / - **5686 FIBRE PULL BOX**
NTS





H / - **WATERMAIN HYDRAULIC PROTECTION**
NTS

ISSUE	DATE	DESCRIPTION
9	2023-09-07	ISSUED FOR CONSTRUCTION REV 7
8	2023-07-06	ISSUED FOR CONSTRUCTION REV 5
7	2023-06-28	ISSUED FOR CONSTRUCTION REV 4
6	2023-06-15	ISSUED FOR CONSTRUCTION REV 3
5	2023-06-02	ISSUED FOR CONSTRUCTION REV 2
4	2023-05-12	ISSUED FOR CONSTRUCTION
3	2023-04-11	POST-TENDER MODIFICATIONS

PROJECT MANAGER	M. DAY
CIVIL	MD
STRUCTURAL	
ARCHITECTURAL	
PROCESS	
MECHANICAL	
ELECTRICAL	
INSTRUMENTATION	
PROJECT NUMBER	E20307

EGBC PERMIT TO PRACTICE #1001547

WHISTLER
Whistler, BC

SOUTH WHISTLER WATER SUPPLY PHASE 1

2023

STANDARD DETAILS SHEET 2

FILENAME: 10299470-C01-101-C009.dwg
SCALE: AS NOTED
SHEET: **C010**

FRONTERA GEOTECHNICAL

1 – 38920 Queens Way
Squamish, BC V8B 0K8
604-898-1093

HDR
500 – 1500 West Georgia Street
Vancouver, BC
V6G 2Z6

February 10, 2023
File: 1956

Attention: Suzi Martin

RE: Preliminary Geotechnical Report, Proposed South Whistler Booster Pump, Water Treatment Facility and Water Supply Project, Resort Municipality of Whistler, BC

1.0 INTRODUCTION

We understand that as part of the South Water Supply Project, the Resort Municipality of Whistler (RMOW) has proposed to install a new watermain, booster pump and water treatment facility in Whistler. Frontera Geotechnical Inc. (Frontera) has been engaged to provide geotechnical recommendations to support the design and construction of the new watermain (Phase 1) as well as for the new booster pump and water treatment facility (Phase 2).

Frontera completed a geotechnical investigation along the proposed watermain alignment and in the location of the booster pump and water treatment facility. This report presents the findings of our investigation and provides general recommendations for the design and construction of the proposed improvements.

This report has been prepared exclusively for our client, for their use, the use of others on the design team and the RMOW for use in the development and permitting process, however, it remains the property of Frontera.

2.0 PROJECT DESCRIPTION

We have reviewed the civil engineering drawings prepared by HDR dated August 16, 2022, in preparing this report. We understand that Phase 1 of the project will include the following:

- The installation of approximately 725 m lineal meters of new watermain.
    - The watermain is to run from the existing Function Junction Pump Station on Lynham Road, underneath Highway 99, and along Cheakamus Lake Road to the location of the proposed new booster pump and water treatment facility east of the Whistler Wastewater Treatment Plant.
    - The watermain is to be 250 mm diameter and comprised of ductile iron where the main is located underneath, and to the north, of Highway 99, and will transition to a 400 mm diameter main south of Highway 99.
    - The watermain is to be generally 3 to 4 m below ground.

The grades along the watermain alignment are relatively flat and range from roughly 601 m to 604 m with a gentle slope up to the south. The majority of the proposed alignment is covered by either asphalt or

crushed rock gravel shoulder, with occasional areas of grassed embankment. The majority of the new alignment will be completed adjacent to the existing watermain and will cross over numerous existing utilities.

As part of Phase 2 of the project we understand that the following is proposed:

- The construction of a new booster pump station and water treatment facility.
- The new facility is to have a building footprint of approximately 12.3 m x 19.6 m.
- The new facility is to be constructed immediately north of the Cheakamus Pump Station, which is located to the east of the Whistler Wastewater Treatment Plant (WWTP).

The proposed new treatment facility is located on the WWTP access road, and is bound to the south by the Cheakamus Pump Station, to the east by undeveloped land and Cheakamus Lake Road, to the west by the Whistler WWTP, and to the north by Highway 99. The elevation at the location of the new facility is approximately 604 m geodetic and is currently grass and asphalt covered.

3.0 FIELD INVESTIGATION

Frontera completed a geotechnical investigation on January 13, 2023. The investigation comprised of four augered test holes along the watermain alignment (TH23-07 to TH23-10) advanced to 4.6 m depth. The test holes were supplemented with four dynamic cone penetration test (DCPT) soundings to help characterise the in-situ density of the underlying soils.

DCPT soundings are completed by driving steel rods with a blunt tip into the ground using a standardized mechanical drop hammer. The number of blows from the drop hammer required to advance the rods are recorded in 300 mm intervals. The number of blows required to drive the rods 300 mm can be used for inference of the in-situ density of granular soils and fills and consistency of fine-grained soils.

Six augered test holes were also completed within the footprint of the proposed booster pump facility (TH23-01 to TH23-06). Refusal was met at shallow depths in all six test holes at between 0.75 and 0.9 m. Additional test holes were completed at this location to help confirm bedrock was present and that drill refusal was not due to boulders.

The approximate locations of the test holes are shown on the attached site plan, our Drawing No. 1956-01.

4.0 SUBSURFACE CONDITIONS

4.1 Proposed Watermain Alignment

4.1.1 Soil Conditions

The Geological Survey of Canada Map Open File 5324 describes the area along the alignment as Floodplain Sediments typically comprised of sand and silt, commonly including organic materials and underlain in many places, by gravel; 1 to 3 m thick; occurring as flat surfaces close to river level. The southern edge of the alignment borders on Ice Contact Deposits; sands and gravels, stratified to massive and commonly faulted; generally > 3 m thick, forming hummocky surfaces.

The soil encountered within our investigation along the watermain alignment comprised of granular fill overlying sand to sand and gravel with exception to near the existing pump station on Lynham Road where the fill was underlain by organic topsoil over sand with some silt. A general description of the soils encountered is as follows:

FILL

Fill was encountered in all four test holes along the alignment (TH23-07 to TH23-10). The fill in TH23-07, 08, and 09 was generally comprised of sand / sand and gravel with varying amounts of cobbles and was between 1.0 m o 1.8 m thick. The fill is generally well graded and compact to dense.

At TH23-10 the fill is a fine to medium grained sand with some silt, organic roots and rootlets. The fill is loose to very loose and moist to wet. The moisture content from lab analysis of samples taken within the fill at this location are 22 %.

Organic TOPSOIL

At TH23-10 the fill was underlain by a 1.7 m thick layer of organic topsoil which was noted to be fine grained, loose and dry to moist. The topsoil has a high organic content with roots, rootlets, rotten wood and decomposing leaf matter present within. Moisture contents from lab analysis of samples taken within the sand range from 43 to 46 %.

SAND

Underlying the fill is variable sand was, encountered to depths between 3.0 to greater than 4.5 m. The sand grades from fine to coarse grained and is poorly graded with trace subrounded gravel at various depths and in TH23-08 and TH23-10 contains trace to some silt between 2.9 and 4.5 m. Based on the DCPT blow counts the sand ranged from compact to very dense.

SAND and GRAVEL

Sand and gravel was encountered in TH23-07 at a depth of 3.0 m. This deposit contained fine to coarse grained sand and gravel, some cobbles and was well graded. The material was noted to be dense to very dense, dry and grey.

4.1.2 Groundwater Conditions

The groundwater was encountered in test holes TH23-08, TH23-09 and TH23-10 and was estimated to be between 0.9 m to 3.1 m below existing grades at the time of our investigation. Groundwater was not encountered in TH23-07 which was advanced to 4.5 m below grade. This corresponds to an approximate geodetic elevation of 597.1 m to 600.8m. The water table is expected to vary seasonally, with generally higher groundwater levels following periods of sustained precipitation or snow melt.

4.2 Proposed Booster Pump & Water Treatment Facility

4.2.1 Soil Conditions

The Geological Survey of Canada Map Open File 5324 describes the area as Ice Contact Deposits; sands and gravels, stratified to massive and commonly faulted; generally > 3 m thick, forming hummocky surfaces.

Soils encountered at the proposed booster pump facility comprised of sand overlying shallow inferred bedrock. A general description of the soils encountered is as follows:

SAND

Sand with some gravel was encountered in all test holes completed within the proposed treatment facility area. The deposit was generally well graded, dense, dry and was orange/brown in colour.

BEDROCK (Inferred)

The auger met refusal at depths ranging between 0.76 to 0.9 m on inferred bedrock. Six test holes (TH23-01 to TH23-06) were completed to obtain a general bedrock profile.

For a more detailed description of the subsurface conditions refer to test hole logs in Appendix A.

4.2.2 Groundwater Conditions

The groundwater table was not encountered within any of the test holes and is expected to be below development grades. However, perched groundwater conditions could be encountered above the bedrock.

5.0 DISCUSSION

5.1 General

As part of the South Water Supply Project it is proposed to construct 725 linear meters of new watermain within Function Junction in Whistler during Phase 1 of the project. The depth of the proposed watermain ranges from 3 to 4 m below existing grade. Phase 2 of the project will include the construction of a new booster pump and water treatment facility.

Our drill investigation indicates that the new watermain alignment will likely be founded in native sand deposits. The groundwater table was found to range between 0.9 m to greater than 4.5 m along the alignment and the underlying sand deposits are highly permeable. Therefore, if excavations extend below the water table they will be prone to sloughing and collapse. It is expected that dewatering may be necessary to allow for construction of the watermain where it is below the water table and to help ensure that the sand provides a stable base for construction. Bedrock may be encountered in areas note drilled.

Shallow bedrock was encountered in the area of the proposed booster pump and water treatment facility. We expect that blasting may be required depending on the depth of excavation associated with utility installations beneath and near to the building. Perched water should be expected in excavations above the bedrock surface.

Provided the geotechnical considerations above are addressed as described below, we are of the opinion that the project is feasible from a geotechnical standpoint.

5.2 Seismic Considerations

The proposed development site is located within a seismically active zone. It is generally accepted that loose to compact sands prone to liquefaction or strain softening during cyclic loading caused by large earthquakes. Once liquefaction has been triggered, experience has shown that permanent vertical and horizontal ground movements may be experienced. Localized zones beneath the watermain where the sand was loose and below the water table may be prone to liquefaction.

We understand that in Whistler, typically services are not designed to resist the effects of seismicity or liquefaction which would include vertical settlement and horizontal movements. It should be appreciated that following a major earthquake event such as the 1 in 475 or 1 in 2,475 seismic hazard events that significant damage to services could occur.

The new treatment facility is expected to be underlain by bedrock and is therefore not susceptible to liquefaction.

6.0 DESIGN RECOMMENDATIONS

6.1 Phase 1: Watermain Installation

6.1.1 Dewatering

The water table was estimated at depths ranging from 0.9 to 3.1 m below existing site grades from station 1+000 to 2+010 at the time of our investigation. Therefore, the water table may be encountered during excavation along portions of the alignment. The groundwater table was not encountered in TH23-07 which was located at station 2+260.

If the water table is encountered, it should be expected that the highly permeable underlying soils will produce a high volume of water into excavations. Depending on the design elevations, it may be possible to install the watermain without the use of well point de-watering in the summer months when the groundwater level is generally lower. If a manageable amount of groundwater is encountered, we expect that conventional sumps and pumps would be sufficient to dewater the trenches.

If it is necessary to install the watermain below the water table, it is recommended to utilize well-point dewatering prior to excavating below the water. The water table should be lowered to at least 0.6 m below the underside of the pipe trench prior to excavating to minimize the potential for heaving, softening, or seepage at the excavation base. In addition, local sump pumps may be necessary.

The design of the dewatering system should be carried out by the contractor. The contractor should be asked to submit their dewatering plan sufficiently prior to construction for concept review.

Water from other sources such as adjacent or intersecting trench lines could be encountered. Local dewatering is not expected to significantly dewater the existing trench lines where perched water conditions could exist. We expect that intersecting trenches would be allowed drain into the excavation and the water would be removed using localized sump pumps.

Perched water table conditions are possible even if well point dewatering techniques are used. If encountered, seepage from these sources is expected to be light to moderate and it may be possible to control them using localized sump pumps.

6.1.2 Excavations

Excavations for the proposed watermain are expected to be between 3 to 4 m below grade. Prior to the watermain installation, any loose fill, topsoil, or organic materials should be removed from the trench to expose a subgrade of undisturbed granular soil or bedrock. Any soft, loose, disturbed or otherwise unsuitable soil should be removed from beneath the proposed pipe alignment prior to placing pipe bedding.

Open cut excavations above the water table are expected to be temporarily stable at slopes of 1H:4V or flatter to allow for installation of temporary shoring cages. Sloughing of trench walls should be expected. Temporary cut slopes could be covered in polyethylene sheeting to help reduce erosion and sloughing. Excavations advanced below the water table are expected to be unstable and will be prone to sloughing, soil migration, and could lead to undermining of the adjacent unsaturated soils. Therefore, as discussed above, dewatering is recommended.

We expect that pre-engineered steel trench shoring cages will be used to ensure worker safety during construction. All work must be carried out in accordance with WorkSafe BC regulations. The contractor must take care to ensure the excavation is maintained in a dry state, seepage is controlled, and disturbance to the subgrade soils is prevented. Any subgrade soils disturbed during the work for whatever reason must be removed and be replaced with approved bedding material.

The use of temporary shoring cages will not provide the required support for the trench walls to ensure that no movement occurs, therefore, some movements should be expected due to soil relaxation. Soils failure, which could impact the adjacent roadway or other nearby infrastructure, could occur. Due to this, adequate measures should be undertaken by the contractor to support and protect all existing improvements.

Construction techniques which could be considered by the contractor to mitigate the potential for impacts to existing infrastructure include, digging in the trench shields from the surface whilst backfilling the space between the shield and trench sidewall; using pneumatic shores to apply positive pressure to the trench sidewall; exposing and supporting any services independently from the soil, or other speciality techniques.

Shallow bedrock was encountered in the area of the proposed booster pump and water treatment facility. We understand that excavations for the new watermain in this area will be approximately 2.0 m below existing grade and therefore excavation within the bedrock may be necessary and blasting will likely be required.

All work must be carried out in accordance with WorkSafe BC regulations.

6.1.3 Backfill

We recommend that all work be carried out in general accordance with MMCD specifications.

Backfill materials will be required within the pipe trench to provide support for the pipe within the pipe zone and to ensure an adequate subgrade beneath all road pavement sections.

Base preparation beneath the pipes and manholes should be completed with 19 mm crushed rock lightly compacted in place.

Backfill within the pipe zone should be completed with 19 mm minus crushed rock compacted to a minimum of 95% Modified Proctor maximum dry density.

Bulk backfill materials should consist of well graded sand or sand and gravel fill compacted to a minimum of 95% Modified Proctor maximum dry density.

The contractor should be asked to provide density reports confirming that the specified level of compaction has been achieved. Frontera can provide quality assurance density testing upon request.

The existing excavated fill and native sand encountered within the test holes may be suitable for reuse as bulk backfill with exception to TH23-10 where the sand material contained high amounts of silt and where the organic topsoil horizon was encountered. Frontera can be asked to review the material at time of construction to confirm.

6.1.4 Pavement Restoration

We expect that the following pavement structure, which meets the requirements of the Resort Municipality of Whistler's "Temporary and Permanent Pavement Restoration", would be sufficient to support the anticipated traffic.

Table 2. Recommended **minimum** pavement structure:

Material	***Thickness (mm)***
Asphalt (50 mm base course, 40 mm surface course)	100
19 mm minus crush gravel base	150
100 mm minus, well graded, clean, sand and gravel subbase course	300

All base and sub-base materials should be compacted to a minimum of 95% of their Modified Proctor Maximum Dry Density (ASTM D1557) at a moisture content that is within 2% of optimum for compaction.

6.2 Phase 2: Booster Pump and Water Treatment Facility

6.2.1 Stripping

Prior to construction, all existing vegetation, asphalt, topsoil, disturbed or loose fill, and any other material which may compromise our design recommendations should be removed from the construction area to expose a subgrade consisting of bedrock.

6.2.2 Temporary Excavations

Design details for the proposed facility and associated services are not known. However, we understand that the watermain adjacent to the facility will be approximately 2.0 m below existing grade. Bedrock is expected at between 0.7 and 0.9 m below grade based on our test hole information.

Where excavation in bedrock is required, we expect that blasting may be necessary. We expect that the rock will be strong and self-supporting and therefore, excavation slopes of 1H:4V are expected to be stable, however, this must be confirmed at the time of excavation.

All excavations and trenching must conform to WorkSafeBC requirements or be designed by a professional engineer prior to worker entry.

6.2.3 Engineered Fill

Any grade reinstatement beneath foundations or grade supported slabs, should be completed with "engineered fill". In the context of this report any "engineered fill" is defined as clean sand to sand and gravel fill, containing less than 8% fines, compacted in 300 mm lifts to a minimum standard of 95% of its Modified Proctor Maximum Dry Density (ASTM D698) while at a moisture content that is within 2% of its optimum for compaction.

6.2.4 Foundation Recommendations

6.2.4.1 Foundation Design

The structures can be founded on conventional spread foundations placed on compacted fill, or bedrock.

Foundations supported directly on engineered fill can be designed for a serviceability limit state (SLS) bearing pressure of 150 kPa and ultimate limit state (ULS) of 300 kPa.

Foundations supported directly on competent bedrock can be designed for a serviceability limit state (SLS) of 500 kPa and a factored ultimate limit state (ULS) of 1 MPa.

We recommend that a level pad (i.e., less than 10 degrees from horizontal) is created in the bedrock subgrade through excavation and chipping. If a level pad is not achievable and the subgrade is sloped between 10 and 30 degrees, the foundations should be dowelled into the rock for additional support. Any rock subgrade exceeding 30 degrees should be benched so that it is less than 30 degrees.

The foundation subgrade must be reviewed by Frontera prior to pouring of foundations.

6.2.4.2 Subgrade Modulus

We recommend that the structural engineer consider a subgrade reaction modulus of 60 MPa/m for preliminary design if the foundations are to bear on the engineered fill or a subgrade reaction modulus of 500 MPa/m if the footings bear directly on bedrock. However, the actual modulus should be confirmed, through testing, at the time of initial site preparation.

6.2.4.3 Frost Protection

The underside of foundations should be located at least 0.6 m below finished site grades for frost protection.

6.2.4.4 Settlement of Foundations

Post construction settlements are estimated to be less than 25 mm with differential settlements of less than 1 in 300.

6.2.4.5 Seismic Design of Foundations

The soils at the site are not considered susceptible to liquefaction or strain softening when considering the 2018 BCBC seismic hazard. The seismic site response classification for this site is “Site Class A” in accordance with Table 4.1.8.4.A of the 2018 BCBC.

6.3 Concrete Slabs

Any grade supported concrete slabs should be underlain by a minimum of 150 mm of 19 mm clear crushed gravel, to prevent moisture from accumulating below the slab. The gravel should be tamped in place. We recommend that a poly moisture barrier be placed overlying the gravel beneath the grade supported slabs to help reduce moisture within the concrete slab.

6.4 Foundation Drainage

We recommend that a conventional perimeter drainage system be included in the mechanical design to help intercept and dispose of any migrating subsurface water at foundation level.

6.5 Backfill

Where backfill support hard landscaping we recommend that all backfill be clean sand to sand and gravel fill, containing less than 5% fines, compacted in 300 mm loose lifts to a minimum standard of 95% of its Modified Proctor Maximum Dry Density (ASTM D 1557) while at a moisture content that is within 2% of its optimum for compaction.

7.0 FIELD REVIEWS

Frontera Geotechnical Inc. should be asked to carry out sufficient field reviews during construction to ensure that the Geotechnical Design recommendations contained within this report have been adequately communicated to the design team and to the contractors implementing the design. These field reviews are not carried out for the benefit of the contractors and therefore do not in any way affect the contractor's obligations to perform under the terms of their contract.

It is the contractors' responsibility to advise Frontera Geotechnical Inc. (a minimum of 24 hours in advance) that a field review is required. Geotechnical field reviews are normally required at the time of the following:

1.	Excavation	Review of temporary cut slopes and ground conditions;
2.	Stripping	Review of stripped subgrade prior to any fill placement or pipe installation
3.	Subgrade Review	Review of subgrade prior to fill placement or footing construction;
4.	Filling	Review of engineered fill used to raise grades;
5.	Slab-on-grade	Review of engineered fill and drainage layer beneath slabs; and,
6.	Backfill	Review of backfill placement against foundations.
7.	Trench Backfill	Review of materials, placement, and compaction
8.	Road Structure	Review of materials, placement, and compaction

It is critical that these reviews are carried out to ensure that our intentions have been adequately communicated. It is also critical that contractors working on the site view this document in advance of any work being carried out so that they become familiarized with the sensitive aspects of the works proposed. It is the responsibility of the developer to notify Frontera Geotechnical Inc. when conditions or situations not outlined within this document are encountered.

8.0 CLOSURE

This report is prepared solely for use by our client and their design team for this project as described to the general standards of similar work for similar projects in this area and no other warranty of any kind is expressed or implied. Frontera Geotechnical Inc. accepts no responsibility for any other use of this report.

We are pleased to assist you with this project, and we trust this information is helpful and sufficient for your purposes at this time. Please do not hesitate to call the undersigned if you require clarification or additional details.

Yours truly,

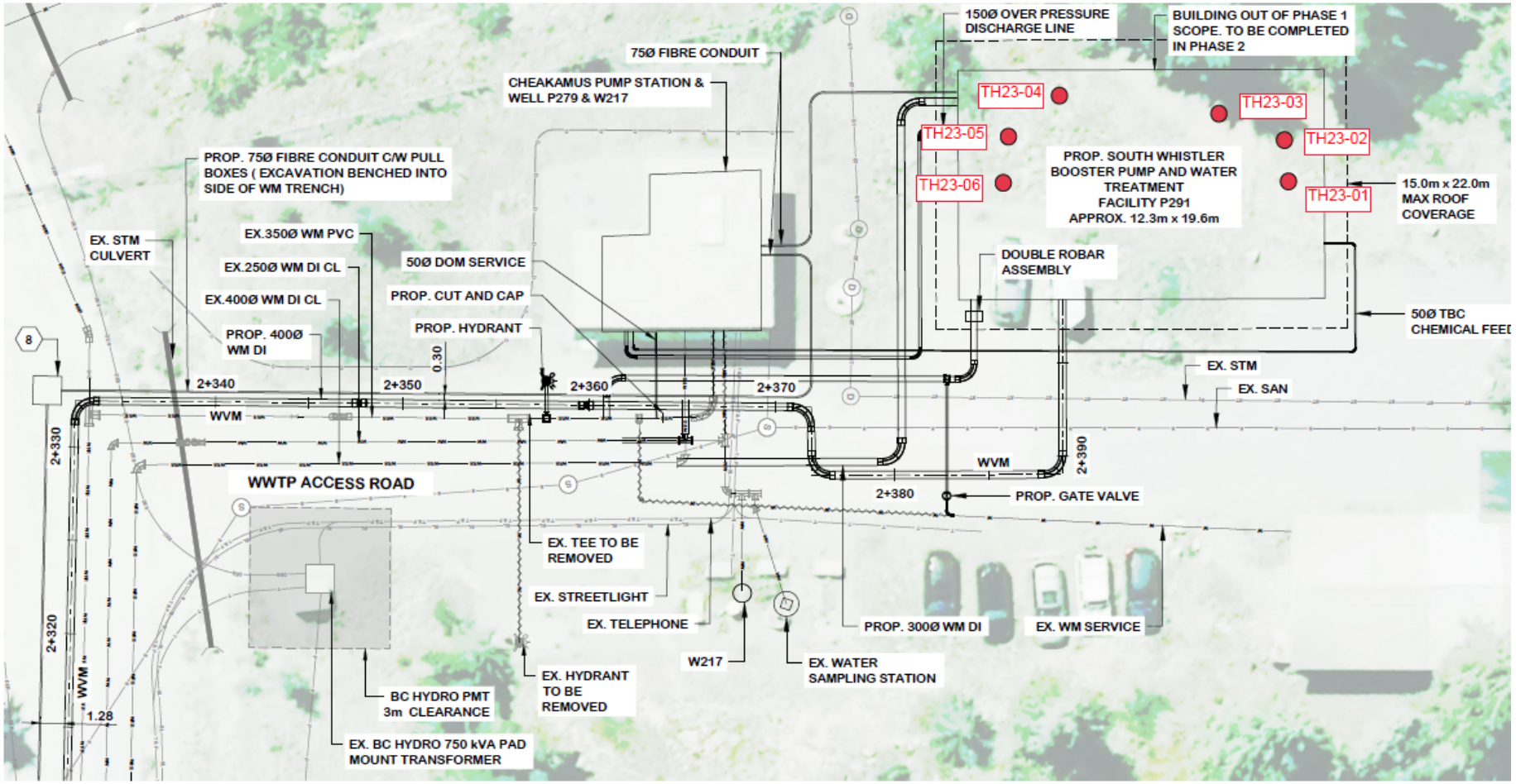
Frontera Geotechnical Inc.

Sam Gregory, B.Sc.
Project Manager

Jessica Gagne, P.Eng.
Geotechnical Engineer

Reviewed by:

Steven Fofonoff, M.Eng., P.Eng.
Principal



Geotechnical Investigation Plan
Proposed South Whister Booster Pump and Water Supply Project
Whistler. BC

FILE NO. 1956

DWG NO. 1956 - 01

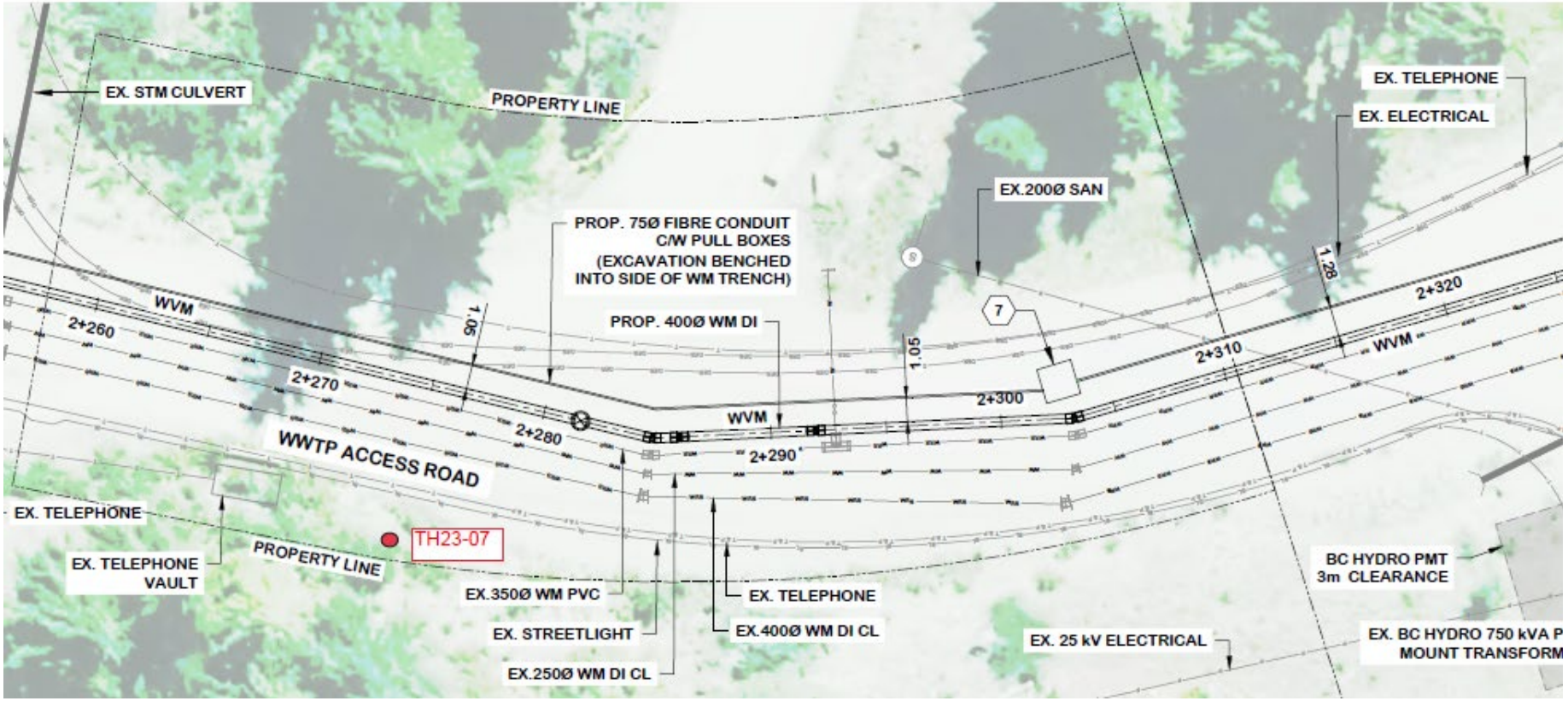
LEGEND
- Auger Test Hole

Date: 2023-18-01

Drawn By:	Approved By:	Reviewed By:
SG	SF	

Scale: NTS, Locations Approximate

FRONTERA GEOTECHNICAL



Geotechnical Investigation Plan
Proposed Home
1000 Laramee Road, Squamish, BC

FILE NO. 1950

DWG NO. 1950 - 01

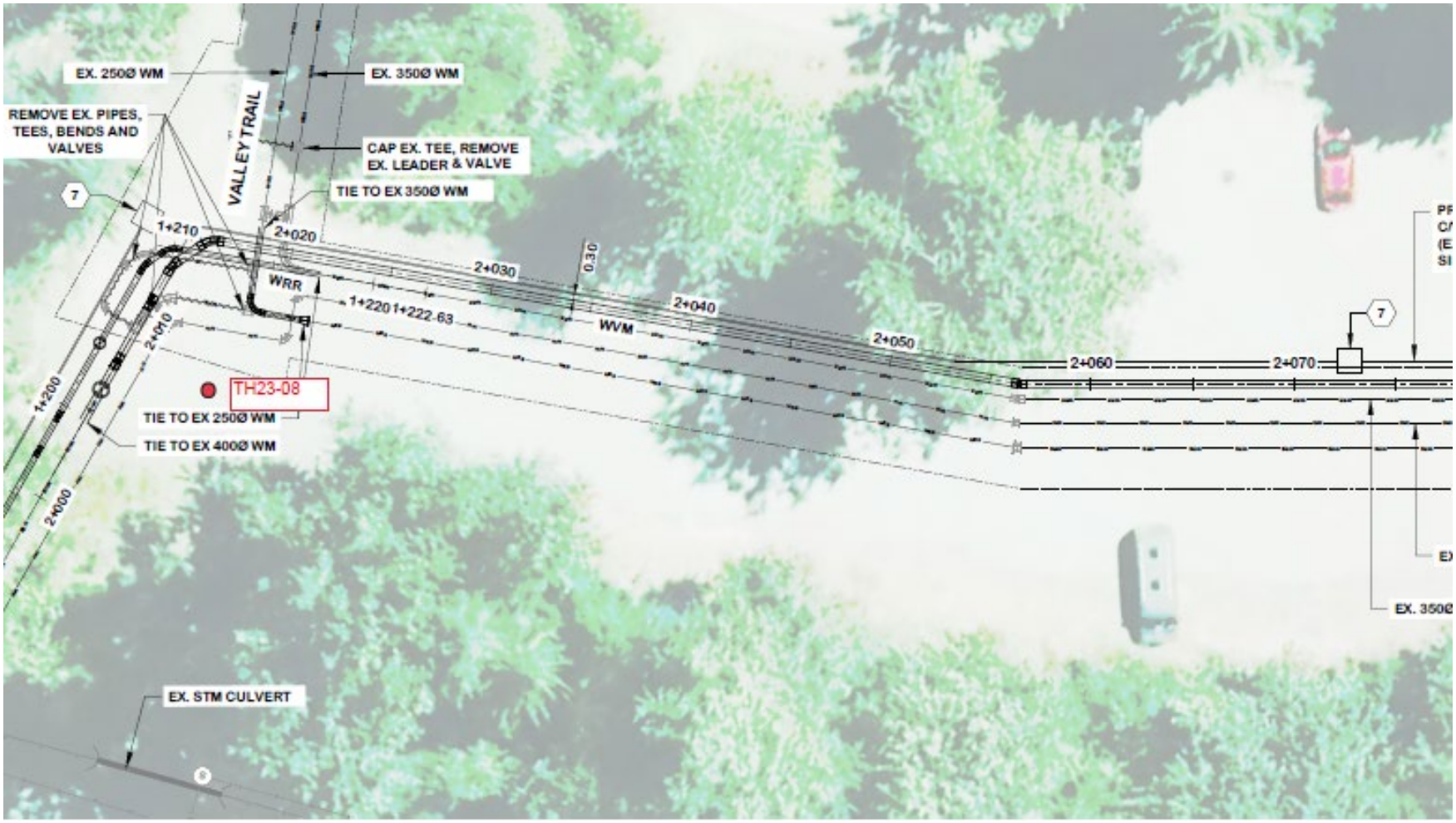
LEGEND
Auger Test Hole

Date: 2022-12-05

Drawn By:	Approved By:	Reviewed By:
SG	SF	

Scale: NTS, Locations Approximate

FRONTERA GEOTECHNICAL



Geotechnical Investigation Plan
Proposed Home
1000 Laramee Road, Squamish, BC

FILE NO.
1950

DWG NO.
1950 - 01

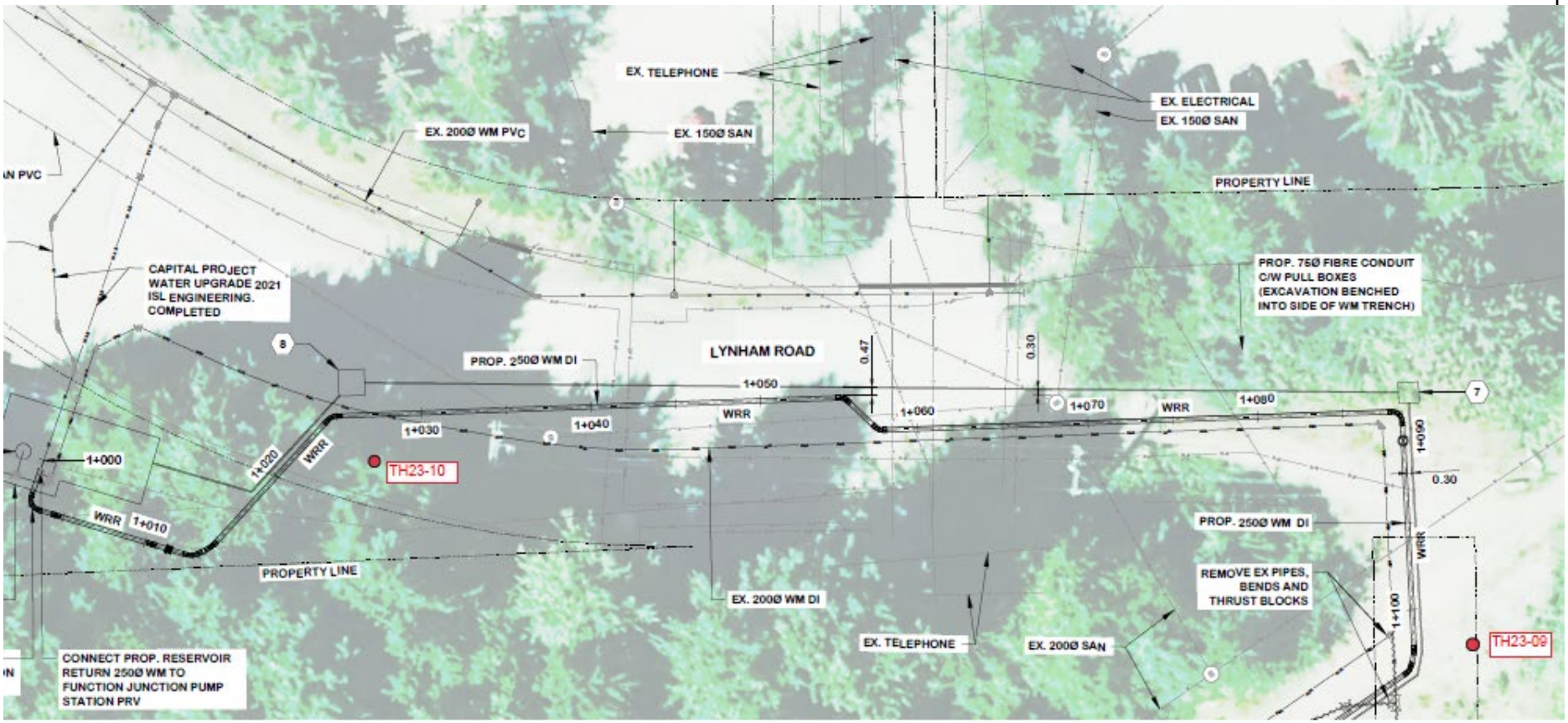
LEGEND
Auger Test Hole

Date: 2022-12-05

Drawn By:	Approved By:	Reviewed By:
SG	SF	

Scale: NTS, Locations Approximate

FRONTERA GEOTECHNICAL



Geotechnical Investigation Plan
Proposed Home
1000 Laramee Road, Squamish, BC

FILE NO.
1950

DWG NO.
1950 - 01

LEGEND
Auger Test Hole

Date: 2022-12-05

Drawn By:	Approved By:	Reviewed By:
SG	SF	

Scale: NTS, Locations Approximate

FRONTERA GEOTECHNICAL

APPENDIX A

TEST HOLE LOGS

Test Hole Log: TH23-01

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.0853, -123.03779

FRONTERA GEOTECHNICAL
#1 - 38920 Queens Way
Squamish, BC V8B 0K8
604-898-1093
www.fronterageo.ca

Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) 0 12 24 36 48 60	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 603.81 m					
0		**SAND with some gravel.** Fine to coarse grained sand, fine to coarse subangular gravel, well graded, dense, dry, orange/brown. 0.76 m EL 603.05 m				No Data	0.76 m - Auger refusal, test hole terminated on possible bedrock.
1		End of Test Hole at 0.76 m					
2							
3							
4							
5							
6							
7							
8							
9							
10							

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-02

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08524, -123.03799

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Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) 0 12 24 36 48 60	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 603.96 m					
0		**SAND with some gravel.** Fine to coarse grained sand, fine to coarse subangular gravel, well graded, dense, dry, orange/brown. 0.91 m EL 603.05 m				No Data	
1		End of Test Hole at 0.76 m					0.91 m - Auger refusal, test hole terminated on possible bedrock.
2							
3							
4							
5							
6							
7							
8							
9							
10							

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-03

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08518, -123.03803

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Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) 0 12 24 36 48 60	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 603.96 m					
0		**SAND with some gravel.** Fine to coarse grained sand, fine to coarse subangular gravel, well graded, dense, dry, orange/brown. 0.91 m EL 603.05 m				No Data	
1		End of Test Hole at 0.91 m					0.91 m - Auger refusal, test hole terminated on possible bedrock.
2							
3							
4							
5							
6							
7							
8							
9							
10							

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-04

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08507, -123.03794

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Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) 0 12 24 36 48 60	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 603.81 m					
0		**SAND with some gravel.** Fine to coarse grained sand, fine to coarse subangular gravel, well graded, dense, dry, orange/brown. 0.76 m EL 603.05 m				No Data	0.76 m - Auger refusal, test hole terminated on possible bedrock.
1		End of Test Hole at 0.76 m					
2							
3							
4							
5							
6							
7							
8							
9							
10							

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-05

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08509, -123.03799

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Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) 0 12 24 36 48 60	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 603.81 m					
0		**SAND with some gravel.** Fine to coarse grained sand, fine to coarse subangular gravel, well graded, dense, dry, orange/brown.				No Data	
		0.76 m EL 603.05 m					0.76 m - Auger refusal, test hole terminated on possible bedrock.
1		End of Test Hole at 0.76 m					
2							
3							
4							
5							
6							
7							
8							
9							
10							

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-06

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08511, -123.03804

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Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) 0 12 24 36 48 60	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 603.81 m					
0		**SAND with some gravel.** Fine to coarse grained sand, fine to coarse subangular gravel, well graded, dense, dry, orange/brown. 0.76 m EL 603.05 m				No Data	0.76 m - Auger refusal, test hole terminated on possible bedrock.
1		End of Test Hole at 0.76 m					
2							
3							
4							
5							
6							
7							
8							
9							
10							

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-07

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08473, -123.03745

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Depth (m)	Strata	Description	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 603.5 m				
0		**FILL** Trace roots and rootlets, medium grained sand, poorly graded, loose, dry, orange/brown.			No Data	
0.61 m EL 602.89 m		**FILL** Gravelly sand with cobbles, fine to coarse grained sand. fine to coarse angular gravel, subangular cobbles, well graded, compact to dense, moist, brown.	1			
1.83 m EL 601.68 m		**SAND with trace gravel** Fine to coarse grained sand, fine grained subangular gravel, well graded, compact, dry, brown.				
3.05 m EL 600.46 m		**SAND and GRAVEL with some cobbles.** Fine to coarse grained sand, fine to coarse grained angular to subangular gravel, subangular cobbles, well graded, dense to very dense, dry, grey.	2			3.0 m - 4.5 m - difficult drilling. 3.6 m - DCPT refusal on cobbles.
4.57 m EL 598.93 m		End of Test Hole at 4.57 m				No groundwater encountered.

Dynamic Cone Penetration Test (DCPT): 0, 12, 24, 36, 48, 60

DCPT values: 4, 5, 8, 25, 59, 25, 10, 22, 14, 25, 40, REF

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-08

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08656, -123.03594

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Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) (0 12 24 36 48 60)	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 602.28 m					
0		**Sand and gravel FILL with some cobbles** Fine to coarse grained sand, fine to coarse grained angular gravel, angular cobbles, well graded, very dense, dry, brown.				No Data	Auger refusal at 0.6 m, moved 0.5 m to south and attempted second test hole. 0.6 m - DCPT refusal, drilled out to 1.5 m then conducted second DCPT.
1.52 m EL 600.76 m			45, 36, REF				Test hole open to 1.2 m.
2		**SAND** Medium grained sand, poorly graded, compact to dense, wet, yellow/brown.		1	20		2.1 m - Second DCPT refusal, loose cobbles from the fill fell down into base of hole.
3.05 m EL 599.24 m							
3		**SAND with trace silt** Fine grained sand, poorly graded, compact, wet, brown.					
4.27 m EL 598.02 m				2	32		
4		**SAND** Medium grained sand, poorly graded, compact, wet, brown.					
4.57 m EL 597.71 m							
5		End of Test Hole at 4.57 m					
6							
7							
8							
9							
10							

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-09

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08774, -123.03477

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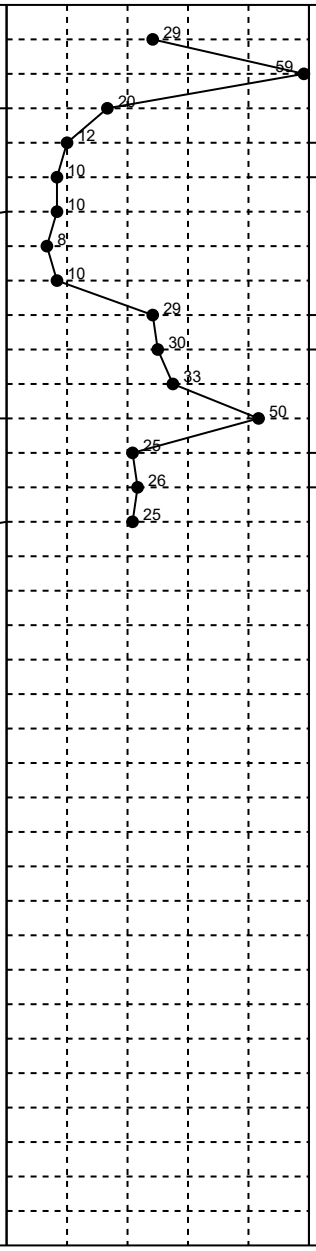
Depth (m)	Strata	Description	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 601.07 m				
0		**Gravelly Sand FILL** Fine to coarse grained sand, fine to coarse grained angular gravel, well graded, dense, moist, brown.			No Data	0.0 m to 0.9 m - poor recovery.
0.91 m (EL 600.15 m)						
1		**SAND with trace gravel** Medium grained sand, fine to coarse grained subrounded gravel, poorly graded, loose, wet, brown.	1	24		Test hole open to 0.9 m.
1.83 m (EL 599.24 m)						
2		**SAND with trace gravel** Fine to coarse sand, coarse grained subrounded gravel, well graded, compact to dense, wet, grey.	2	9		
3.66 m (EL 597.41 m)						
4		**SAND with trace gravel** Fine grained sand, coarse grained subrounded to rounded gravel. gap graded, compact, wet, brown.	3	24		
4.57 m (EL 596.49 m)						
5		End of Test Hole at 4.57 m				

Dynamic Cone Penetration Test (DCPT)



Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165

Test Hole Log: TH23-10

Project No.: 1956 **Client:** HDR

Project Title: South Whistler Water Supply Project

Address: Whistler, BC

Geographic Coordinates: 50.08756, -123.03586

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Depth (m)	Strata	Description	Dynamic Cone Penetration Test (DCPT) 0 12 24 36 48 60	Sample No.	Moisture Content (%)	Groundwater / Well	Remarks
		Ground Surface EL 600.76 m					
0		**FILL** Sand with trace silt, gravel and rootlets, Fine to medium grained sand, fine angular gravel, well graded, loose, moist, brown.	6, 6	1	22	No Data	Surfaced with 19mm crushed gravel.
0.61 m EL 600.15 m		**FILL** Silty SAND with trace gravel, Fine to medium grained sand, fine grained subrounded gravel, well graded, very loose, wet, grey.	1, 2, 0, 0, 0	2	22		Test hole open to 0.9 m
1.22 m EL 599.54 m		**Organic TOPSOIL** Fine grained orgainic sand with rotten wood, roots, rootlets and decomposing leaf matter, very loose, dry to moist, dark brown.	0, 1, 7	3	43		1.5 m - perched water observed in the silty sand.
2.9 m EL 597.87 m		**SAND with some silt** Trace rotten wood, Fine grained sand, poorly graded, compact, moist, grey.	21, 18, 17, 16, 18	4	46		
4.57 m EL 596.19 m		End of Test Hole at 4.57 m		5	35		

Date of Drilling: January 13, 2023

Drilling Method: Solid Stem Auger

Logged By: SG

Datum: BLS Ltd. (01-09-2023)

Hole Diameter (mm) : 165