SPECIFICATIONS

FOR

CSC DRUMHELLER INSTITUTION CHP FIRE PUMP REPLACEMENT
PWGSC PROJECT NO. R.060837.001

ISSUED FOR TENDER

Prepared by:

WSP Canada Inc.
Consulting Engineers
Calgary, AB

WSP Reference No. 181-01555-00

May 2021

Sealed the 4th. day of May 2021.

Mechanical

PROFESSIONAL ENGINEER ALBERTA
STEPHEN GUNDY

04 May 2021

Steve Gundy, P.Eng.
Mechanical Engineer, Alberta Buildings Group

PERMIT TO PRACTICE
WSP CANADA INC.
RM SIGNATURE:
RM APEGA ID #: 81684
DATE: MAY 04, 2021
PERMIT NUMBER: P007641
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Electrical

PROFESSIONAL ENGINEER ALBERTA
KEITH McCOLL ROGERS

2021-05-04

Keith Rogers, P.Eng.
Electrical Engineer, Alberta Buildings Group

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END OF SECTION

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Part 1 Existing Conditions

.1 The Drumheller Institution is located near Drumheller, Alberta along Highway 9 about 2 km south of the Town of Drumheller.

The Drumheller Institution site consists of a Medium Federal Correctional Institution with a Minimum Security Area as well as a Medium Security Area. This Facility can house approximately 700 Inmates.

The existing Fire Pump was installed during the last major upgrade and is located in the northeast corner of the Central Heating Plant. It is a single speed (not capable of variable speeds), 55.9 kW (75 Hp), 600 volt, 689kPa (100 psi), DARLING 63.1 L/s (1000 USGPM) Fire Pump. It is surrounded by water piping.

Over the years the Fire Pump has experienced problems with annual fire pump testing and is in non-compliance with FNCC and NFPA 25.

The existing piping surrounding and leading to/from the existing fire pump are coated with asbestos and lead materials.

The electrical wiring and conduit for the existing fire pump comes up through the concrete floor next to the concrete base that it currently sits on. The electrical MCC panel controlling the unit is on the West side of the Central Heating plant building. Power is fed to the fire pump via the original fire pump control panel which is located on the north wall near the fire pump. This fire pump control panel is permanently assigned to the 'HAND' position and it has been determined that it does not operate correctly.

Presently no dedicated emergency power source is supplied to the existing fire pump, nor is any dedicated electrical service.

Part 2 Work Of This Contract

.1 CSC Drumheller Fire Pump Replacement

.2 Work of this Contract comprises the following:

.1 Replace the existing single speed fire pump (P13) located in the Central Heating Plant (CHP) with two (2) new variable speed fire pumps P-13A & P-13B (with two (2) pressure release valves directed back to the Reservoirs, and piping to two (2) test headers mounted on the East side of the building) that will provide the necessary emergency water flow to the complete site for ALL of the buildings at the lnstitution. The new design must meet the direction established by CSC (Authority Having Jurisdiction at this site) to use NFPA 20 (2010), article 9.2.2.4. All those employed to work on the site are to meet the requirements of the provincially legislated Apprenticeship and Industry Training Act. Tradespersons are to be registered apprentice or certified journeyman, skilled, qualified and supervised.

.2 Update the automated controls for the filling of domestic water storage tanks (two (2) in CHP) and water tower. Existing sensors will be removed from both the water tower and holding tanks. The removal of the existing water sensor will be difficult as it is on old float style system. New radar sensors will be installed. New

sensors will need to be adapted for compatibility with existing control cabinets and systems.

.3 Remediate all hazardous materials in the project area inside Central Heating Plant.

.4 Install BACNET compatible BMS system for monitoring various generator points, the water level in the two (2) storage tanks and water tower. This information is to be displayed in the Central Heating Plant A05 and PIDS B24.

.5 Replace nine (9) broken fire hydrants. Six (6) of the fire hydrants are located inside of the Medium Security Area. Contractor is responsible for coordinating all shut downs with CSC authorities via communication through the Departmental Representative. Contractor is responsible for fire watch and coordination with local fire protection.

.6 Provide normal power to be routed underground from the heating plant to the new 600V utility transformer using a dedicated connection to a dedicated service. The location of the transformer on-site will be coordinated with the Departmental Representative, the local electrical utility and the CSC facility's maintenance team as described above.

.1 Remove existing baseboard radiation and relocate hydronic hot water supply pipe to accommodate electrical equipment.

.7 Provide emergency power to be routed underground from the heating plant to the generator package which will be located directly outside of the heating plant on it's East side. The location of the generator package is to the east of the central heating plant by the existing exit doors on the CHP South East corner. The emergency power generator coolant temperature will be monitored via the Fire Alarm System.

.3 Municipal Address:

CSC Drumheller Institution
Highway 9 South
PO Box 3000
Drumheller, Alberta
T0J 0Y0

Part 3 Contract Time

.1 Date of commencement of the Contract shall be the date of issuance of the Letter of Acceptance.

.2 Upon receipt of Letter of Acceptance, Contractor is to attend a Pre-Construction Start Up Meeting at the site in Building A-01 and will then be required to start work on the project deliverables the same week, with both the procurement of product and the commencement of work at the CSC Drumheller Institution.

.3 The Departmental Representative's pre-planned activities, which will be performed as specified under Performance Testing in Section 01 91 01B, will be completed within approximately one (1) week from date of Interim Acceptance of the Work, provided that

the Departmental Representative's activities are not hampered or delayed by the Work proving to be unready for Performance Testing or the identification of an unreasonable number of Contract Deficiencies.

.4 Achieve interim acceptance on or before November 7, 2022. Work times are from 08:00 to 16:00 daily from Monday through Friday. No weekend work, extended hours or work on Federal/Provincial Holidays will be allowed unless previously approved by the Departmental Representative. The Contractor will be required to bring to site all required workforces needed to complete the Work by the aforementioned date; however, if deemed to be required by the bidding contractor, the cost for additional labour, time, etc. shall be included in Total Stipulated Price Bid Summary.

Part 4 WORK SEQUENCE

.1 Perform work in the following sequence:

.1 Construction start-up meeting, site mobilization.

.1 A Site Access Gate Memo will be required for each contractor and each sub-trade that will be working on the project. These must be delivered to the Departmental Representative 10 business days prior to the contractor coming to the site to allow these documents to be approved by the Client. Failure to comply with this requirement will result in denial of access to the site. All site visits must be arranged via the Departmental Representative.

.2 A Site Specific Safety Plan and a Corporate Safety Plan must be provided (electronic copy) for review and must include all requirements for work at a CSC Institution, including Covid-19 safety protocols.

.3 Provide a detailed construction milestone schedule including proposed dates for equipment deliveries, shutdowns, energization activities, commissioning, etc..

.4 Submit shop drawings for review and approval. Order all long-delivery equipment.

.2 The following major scopes of work will be carried out concurrently:

.1 Fire Hydrant Replacement. Shutdowns, fire watch, coordination with AHJ responsibility of contractor.

.1 Contractor to allow for nine (9) shut downs, one for each of the nine (9) hydrants being replaced.

.2 Removing existing level controls for the two (2) domestic water holding tanks and water tower and install new sensors.

.3 Install two (2) vortex breakers on domestic water pipes from two (2) domestic water holding tanks.

.1 Contractor to allow for two (2) shut downs, one for each of the two (2) domestic water holding tanks. Shut Downs must be

requested at least 7 business days in advance of the planned shut down and a written approval must be received from the Departmental Representative prior to doing any shut down.

.4 Replace six (6) frozen potable water isolation valves in Central Heating Plant.

.5 Installing the BACNET BMS system for point monitoring. The delivered BMS system must be coordinated with the Client to ensure it will meet with the requirements of other BMS systems being installed by other projects. (JCI on FBI project, Associated Engineering on Fire Alarm project)

.1 Install BMS panel in CHP and all associated conduit and control wiring for all end devices within CHP and water tower.

.2 Route BACNET MSTP cable between CHP and PIDS.

.3 Install BMS panel in PIDS, terminate cabling and commission the control/monitoring signals.

.6 Remediation, Site Utility Feed, Generator, Fire Pump, Fire Panel Upgrade. Perform this scope of work in this sequence.

.1 Remediation of project area as shown in mechanical drawings.

.2 Remove existing baseboard radiation in tool room, and reroute hydronic hot water supply lines away from electrical equipment. Install bare-fin radiation.

.3 Perform all site work to route underground conduits for cabling.

.4 Utility Feed to CHP. Perform all work to establish three (3) new electrical services fed from one new 750kVA utility (ATCO Electric) transformer. Supply cabling, directly route two feeds to each of the two new fire pump controllers and route one feed to a new connection to an existing 600V distribution panel in the CHP. Terminate cabling.

.5 Alter existing 600V distribution panel in CHP and perform all new distribution from this panel to their respective loads (including new generator building).

.1 Carry costs for temporary power during alteration work including the temporary installation and operation of at least three (3) portable 600V generators, sized as per notes on electrical drawings. Contractor shall provide fuel for duration of the alteration work.

.6 Install structural concrete pad to accept new Generator Building delivery and permanent installation.

.7 Install Generator Building c/w 600kW generator. Route and terminate cabling of emergency feeds to new fire pump controllers. Commission emergency generator building.

.8 Install fencing around generator building and secure building.

.9 Replace existing fire alarm panel with new Siemens XLS panel and commission panel.

.10 Fire Pump Refer to phasing plan shown in mechanical drawings.

PHASE 1: Supply and Install 200mm "T's" and isolation valves. Site water shutdown will be necessary. Fire watch and coordination with the Client, via the Departmental Representative, is the responsibility of the Contractor.
PHASE 2: Supply and install new fire pump P-13A and control cabinet. Start-up testing and commission P-13A. P-13A must be operational and commissioned before proceeding with PHASE 3.
PHASE 3: Remove existing fire pump P-13, remove existing housekeeping pad for P-13, remove fire pump control cabinet, remove all existing wiring and conduit back to MCC panel. Relabel MCC panel basket to reflect the removal of P-13.
PHASE 4: Install second fire pump P-13B and control cabinet. Start-Up P-13.

Part 5 CONTRACTUAL ARRANGEMENT

.1 Work shall be performed under a single contract under a Stipulated Price Arrangement.

Part 6 CONTRACTOR'S USE OF PREMISES

.1 Contractor shall have partial use of premises for performance of the Work.

.2 Contractor shall limit his use of premises to allow for:

.1 User occupancy.
.2 Product delivery to a specified area where the Contractor must receive all product delivered to the site for this project.

Part 7 USER OCCUPANCY

.1 User will occupy premises during entire construction period. Coordination/cooperation with the Departmental Representative and user's representatives to minimize conflicting schedules and to facilitate continued use of the Institution at all times.

Part 8 RESPONSIBILITY FOR EXISTING PROPERTY

.1 Contractor shall assume responsibility for premises assigned to him for performance of the Work.

.2 Contractor shall assume responsibility for and shall make good damage to existing property attributable to performance of Work of this Contract.

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

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

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Contractor to provide their own 'port a potty' so that access to inmate areas will not be required.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

.1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative seven (7) Calendar days of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for personnel and vehicular traffic.

.4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 SPECIAL REQUIREMENTS

.1 Submit schedule in accordance with Section 01 32 16 - Construction Schedule.

.2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.3 Keep within limits of work and avenues of ingress and egress.

.4 Ingress and egress of Contractor vehicles at site is limited.

1.6 SECURITY

.1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

.2 Security escort:

.1 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.

.2 Submit an escort request to Departmental Representative at least fourteen (14) days before service is needed. For requests submitted within time noted above, costs of security escort will be paid for by Departmental Representative. Cost incurred by late request will be Contractor's responsibility.

.3 Any escort request may be cancelled free of charge if notification of cancellation is given at least four (4) hours before scheduled time of escort. Cost incurred by late request will be Contractor's responsibility.

.4 Calculation of costs will be based on average hourly rate of security officer for minimum of eight (8) hours per day for late service request and of four (4) hours for late cancellations.

1.7 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 Intent

.1 This Section is to be read in conjunction with, and is subject to, Division 01.

.2 The General Conditions of Contract provide for valuation of changes by three (3) different methods: lump sum, unit price, and cost plus.

.3 All changes or deviations from the original contract documents, whether monetary or non-monetary, shall be implemented via the use of a Change Order. The Contractor shall submit a written quotation for the Contemplated Change Notice (CCN). The Contractor will indicate what impact, if any, the CCNs will have on the project schedule, failure to do so will indicate acceptance of the change by the Contractor, without change to the completion date. The Contractor shall obtain written authorization from the Project Manager for any change to contract documents PRIOR to proceeding with any change or extra work to the contract. Any changes and/or claims for extra work done without prior official authorization in the form of a PSPC Change Order, may not be recognized.

Part 2 Definitions

.1 "Administrative Fee" means the fee permitted for the administration of all paperwork related to a change in the work and any other work not covered by Direct Cost and Overhead Cost. The Administrative Fee does not cover profit.

.2 "Construction Equipment Cost" means the cost of rented or owned equipment, including cost of loading, transportation, unloading, erection, maintenance, fuel, dismantling and removal. This excludes small tools customarily used to carry out the Work by workers and valued at less than $500.00.

.3 "Direct Cost" means actual costs of material and labour as used in the valuation of changes article in the General Conditions of Contract. Direct Cost is the sum of costs directly related to or necessarily and properly incurred by Contractor, Subcontractors and Sub-subcontractors in the performance of a change in the Work. Direct Cost shall exclude Overhead Cost and profit but shall include:

.1 Operation and maintenance of site offices,
.2 Administration at site offices,
.3 Material Cost,
.4 Total Labour Cost,
.5 Travel and Subsistence Cost,
.6 Temporary Work Cost,
.7 Construction Equipment Cost,
.8 Additional bonding and insurance cost,
.9 Salaries and other compensation of on-site superintendents and other supervisory personnel,
.10 Planning, estimating, and scheduling of work costs,
.11 Consumable and expendable materials for small tools, and
.12 Schedule Impact Cost, only where the change has an impact on critical path items,

.4 "Direct Labour Cost" means base wage costs of employees including overtime premium where applicable, but excludes Payroll Burden Cost.

.5 "Material Cost" means cost of all Materials, including transportation and storage thereof. All rebates, refunds, returns from sale of surplus Materials, and trade discounts other than prompt payment discounts, shall be credited to the Contract.

.6 "Overhead Cost" means Contractor's, Subcontractors' and Sub-subcontractors' costs related to:

.1 operation and maintenance of head offices and branch offices,
.2 administration at head offices and branch offices,
.3 general management, legal, audit, and accounting services,
.4 buying organization,
.5 corporate tax,
.6 financing and other bank charges,
.7 salaries and other compensation of off-site personnel,
.8 recruitment and training of on-site staff, and
.9 all other costs not defined as direct costs.

.7 "Payroll Burden Cost" means actual costs paid by the employer for statutory charges and benefit costs additional to Direct Labour Cost. It includes the employer's contributions to Canada Pension Plan, Employment Insurance, Workers' Compensation Board, vacation pay, statutory holiday pay, health and wellness plan, and pension plan. It also includes the actual employer paid incentives for expendable and non-expendable small tools with a value of less than $500.00, safety and protective equipment, education and training, and other payroll costs which are hourly wage dependent.

.8 "Schedule Impact Cost" means Contractor's, Subcontractors' and Sub-subcontractors' costs related to an increase in the Contract Time where the change has an impact on the Project's critical path.

.9 "Temporary Work Cost" means cost of temporary structures, facilities, services, controls, and other temporary items used in the performance of a Change in the Work, including maintenance, dismantling and removal, less any residual value after dismantling and removal.

.10 "Total Labour Cost" means sum of Direct Labour Cost and Payroll Burden Cost.

.11 "Travel and Subsistence Cost" means travel and subsistence costs incurred by employees when working beyond a reasonable commuting distance from their normal place of residence.

Part 3 Schedule of Labour Rates

.1 Submit to the Departmental Representative for approval, within twenty-one (21) days after date of commencement of Contract, a Schedule of Labour Rates consisting of the following columns: Name of the Trade, Trade Classification, Direct Labour Cost per hour, Payroll Burden Cost per hour and Total Labour Cost per hour.

.2 Labour rates stated in Schedule shall be the hourly labour rates that will be applied when estimating increases and decreases in cost resulting from changes in the Work. Assume that work will be performed during regular working hours, not premium time.

.3 Approved Schedule of Labour Rates will be used solely for evaluating Contractor Proposals for changes in the Work. Nothing specified herein, nor the submission of a Schedule of Labour Rates by Contractor, shall be construed to mean that the Departmental Representative has established, or will establish, minimum wages or benefits applicable to the Work, other than those required by law.

.4 Include all trades that will be employed in the Work, including trades employed by Subcontractors and Sub-subcontractors.

.5 Provide a breakdown indicating hourly labour rates for Direct Labour Cost, Payroll Burden Cost, and the resulting total labour cost for journeymen, apprentices, foremen and other applicable classifications within each trade.

.6 Labour rates stated in Schedule shall be consistent with rates that will actually be paid in the normal performance of the Work, during regular working hours, and shall not exceed the following:

.1 Where collective agreements apply:

.1 rates for Direct Labour Cost shall not exceed rates established by collective agreements, and

.2 rates for Payroll Burden Cost shall not exceed rates established by collective agreements and statutory charges.

.2 Where collective agreements do not apply:

.1 rates for Direct Labour Cost shall not exceed rates prevailing in the locality of the Project, and

.2 rates for Payroll Burden Cost shall not exceed 45% of rates for Direct Labour Cost.

.7 The Departmental Representative's approval of rates provided in the Schedule of Labour Rates will be conditional upon compliance with the foregoing requirements. Approval will be based on most current information available to the Province on Alberta construction industry wages and benefits.

.8 Contractor may request an amendment to an approved rate stated in the Schedule of Labour Rates, if and when required on account of a change in the rate that will actually be paid in the normal performance of the Work. If Contractor can prove to the Departmental Representative's satisfaction that a different rate will actually be paid, the Departmental Representative may, at its sole discretion, approve such a change in rate.

Part 4 Change Order Procedures - Lump Sum Method Of Valuation

.1 The Departmental Representative will issue a Request for Proposal to Contractor.

.2 Contractor shall submit a Contractor Proposal stipulating:

.1 a lump sum increase, decrease, or no change in the Contract Price, and

.2 an increase, decrease, or no change in the Contract Time,

on account of the proposed change in the Work.

.3 Include in Contractor Proposal a detailed breakdown of lump sum increase or decrease, indicating Contractor's, and where applicable Subcontractors' and Sub-subcontractors':

.1 itemized direct costs applicable to the proposed change in the Work, and

.2 applicable amounts for overhead and profit, in accordance with percentages specified in the General Conditions of Contract.

Do not include costs that would otherwise be incurred in the normal performance of the Work.

.4 Include in detailed breakdown of Contractor Proposal a further breakdown of the total labour cost component indicating, for each applicable trade and trade classification, the labour rate(s) and the number of hours from which the total labour cost is derived.

.5 Include in detailed breakdown of Contractor Proposal only those labour rates included in Schedule of Labour Rates and previously approved by the Departmental Representative, in writing, unless the extra work cannot be performed during regular working hours and the Departmental Representative has given approval, in writing, for premium time labour rates.

.6 Upon the Departmental Representative's approval and acceptance of the Contractor Proposal, a "Change Order" will be issued to Contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Standard Acquisition Clauses and Conditions (SACC) Manual

.1 https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

.2 Make applications for payment on account as monthly as Work progresses.

.3 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.

.4 Submit to Departmental Representative, at least fourteen (14) days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

1.3 SCHEDULE OF VALUES

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

.2 Provide schedule of values supported by evidence as Departmental Representative may reasonably direct and when accepted by Departmental Representative, be used as basis for applications for payment.

.3 Include statement based on schedule of values with each application for payment.

.4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Departmental Representative may reasonably require too establish value and delivery of products.

1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS

.1 Submit separate schedule of unit price items of Work requested in Bid form.

.2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:

.1 Cost of material.
.2 Delivery and unloading at site.
.3 Sales taxes.
.4 Installation, overhead and profit.

.3 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

1.5 PROGRESS PAYMENT

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

.2 Departmental Representative will issue to by Departmental Representative, no later than ten (10) days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Departmental Representative determines to be due. If Departmental Representative amends application, Departmental Representative will give notification in writing giving reasons for amendment.

1.6 SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

.2 Prepare and submit to Departmental Representative comprehensive list of items to be completed or corrected and apply for a review by Departmental Representative to establish Substantial Performance Interim Completion of Work or substantial performance of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion which Departmental Representative agrees to accept separately is substantially performed. Failure to include items on list does not alter responsibility to complete Contract.

.3 No later than ten (10) days after receipt of list and application, Departmental Representative will review Work to verify validity of application, and no later than seven (7) days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.4 Departmental Representative: state date of Substantial Performance of Work or designated portion of Work in certificate.

.5 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Departmental Representative, establish reasonable date for finishing Work.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

.2 After issuance of certificate of Substantial Performance of Work:

.1 Submit application for payment of holdback amount.

.2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Departmental Representative might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.3 After receipt of application for payment and sworn statement, Departmental Representative will issue certificate for payment of holdback amount.

.4 Where holdback amount has not been placed in a separate holdback account, Departmental Representative shall, ten (10) days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Departmental Representative and Contractor.

.5 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Departmental Representative may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Departmental Representative.

1.8 PROGRESSIVE RELEASE OF HOLDBACK

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

.2 Where legislation permits, if Departmental Representative has certified that Work of subcontractor or supplier has been performed prior to Substantial Performance of Work, Departmental Representative shall pay holdback amount retained for such subcontract Work, or products supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.

.3 In addition to provisions of preceding paragraph, and certificate wording, ensure that such subcontract Work or products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.9 FINAL PAYMENT

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

.2 Submit application for final payment when Work is completed.

.3 Departmental Representative will, no later than ten (10) days after receipt of application for final payment, review Work to verify validity of application. Departmental Representative will give notification that application is valid or give reasons why it is not valid, no later than seven (7) days after reviewing Work.

.4 Departmental Representative will issue final certificate for payment when application for final payment is found valid.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 General Coordination

.1 Coordinate all construction activities as required to ensure efficient and orderly installation of each part of the Work.

.2 Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule and coordinate construction activities in the sequence required to obtain the best results.

.3 Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

.4 Make adequate provisions to accommodate items scheduled for later installation under separate contract or by the Departmental Representative's own forces.

Part 2 Administrative Procedures

.1 Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities shall include, but not be limited to, the following:

.1 Preparation of schedules.
.2 Installation and removal of temporary facilities.
.3 Delivery and processing of submittals.
.4 Progress meetings.
.5 Contract acceptance procedures.

2.2 General Installation Provisions

.1 Require the installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

.2 Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

.3 Inspect Materials immediately upon delivery and again prior to installation. Reject damaged and defective items.

.4 Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

.5 Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

.6 Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

.7 Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Departmental Representative for final decision.

.8 Supervise construction activities to ensure that no part of the Work, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

Part 3 Cutting and Remedial Work

.1 Do the cutting and remedial work required to make the several parts of the Work come together properly.

.2 Coordinate the Work to ensure that this requirement is kept to a minimum.

.3 Cutting and remedial work shall be performed by specialists familiar with Materials affected and shall be performed in a manner to neither damage nor endanger the Work.

END OF SECTION

Part 1 Pre-Construction Meeting

.1 Schedule a pre-construction meeting within five (5) days after date of commencement of the Contract and prior to commencement of activities at the Place of the Work.

.2 Purpose: to review personnel assignments, responsibilities, and administrative and procedural requirements.

.3 Location: PSPC Offices, Drumheller.

.4 Meeting Chaired By: the Departmental Representative.

.5 Attendees:

.1 Contractor's representatives: Contractor's senior management, Contractor's project manager, Contractor's site superintendent, representatives of major Subcontractors,

.2 Departmental Representative: as determined.

.6 Agenda:

.1 Introduction of the Departmental Representative and Contractor's representative.

.2 Review of significant contractual responsibilities and administrative and procedural requirements.

.3 Other business.

Part 2 Construction Progress Meetings

.1 Schedule regular construction progress meetings during the course of the Work.

.2 Purpose: to monitor construction progress and to identify problems and action required for their solution, to expedite the Work.

.3 Frequency: every two (2) weeks, or as otherwise directed by the Departmental Representative.

.4 Location: Contractor's site office.

.5 Attendees:

.1 Contractor's representatives: Contractor's project manager, Contractor's site superintendent and when so requested by the Departmental Representative, Subcontractors, suppliers and other parties involved in the Work. Contractor's representatives shall be qualified and authorized to act on behalf of the party each represents.

.2 Departmental Representative: as determined.

.6 Meeting Chaired By: Departmental Representative.

.7 Agenda:

.1 Review and approval of minutes of previous meeting.

.2 Review of items of significance that could affect progress.

.3 Other topics for discussion as appropriate to current status of the Work.

.8 Minutes: the Departmental Representative will record minutes and distribute copies to all attendees within seven (7) days after meeting.

Part 3 Commissioning (Pre-Facility Start-Up) Meetings

.1 Commissioning (Pre-Facility Start-Up) meetings shall be held from the start of the Work until the Contractor Start-Up schedules specified in Section 01 32 16, and the Contractor Start-Up report forms specified in Section 01 33 35, have been approved by the Departmental Representative.

.2 Purpose: To monitor development of Contractor Start-Up schedules and Contractor Start-Up report forms.

.3 Frequency: Every two (2) weeks, or as otherwise directed by the Departmental Representative.

.4 Location: Contractor's site office or other location agreed to between the Departmental Representative and Contractor.

.5 Attendees:

.1 Contractor's representatives: Contractor's project manager, Contractor's site superintendent, mechanical and electrical Subcontractors, Commissioning Agent and when so requested by the Departmental Representative, Sub-subcontractors, suppliers and other parties involved in the Work. Contractor's representatives shall be qualified and authorized to act on behalf of the party each represents.

.2 Departmental Representative: as determined.

.6 Meeting Chaired By: Departmental Representative.

.7 Agenda:

.1 Review and approval of minutes of previous meeting.
.2 Review of progress of Contractor Start-Up sub-schedule preparation.
.3 Review of progress of Contractor Start-Up report form preparation.
.4 Identification of problems impeding progress.
.5 Other business.

.8 Minutes: Same as construction progress meetings.

Part 4 Commissioning (Facility Start-Up) Progress Meetings

.1 Commissioning (Facility start-up) progress meetings shall be held during Facility Start-Up.

.2 Purpose: to monitor commissioning (Facility Start-Up) progress and to identify problems and action required for their resolution, to expedite Facility Start-Up.

.3 Frequency: every two (2) weeks, or as otherwise directed by the Departmental Representative.

.4 Location: same as Commissioning (Pre-Facility Start-Up) meetings.

.5 Attendees: same as Commissioning (Pre-Facility Start-Up) meetings.

.6 Meeting Chaired By: Departmental Representative.

.7 Agenda:

.1 Review and approval of minutes of previous meeting.

.2 Review of Commissioning (Facility Start-Up) progress.

.3 Identification of problems impeding progress towards achievement of Commissioning (Facility Start-Up) milestones.

.4 Review of outstanding Contract Deficiencies.

.5 Review of Change Orders and Requests for Proposals.

.6 Other business.

.8 Minutes: same as construction progress meetings.

Part 5 Warranty Meetings

.1 Warranty meetings shall be held between Final Acceptance of the Work and Total Completion of the Work.

.2 Purpose: to bring to Contractor's attention Contract Deficiencies identified during warranty period, determine action required for their correction, and monitor progress of Contract Deficiency correction.

.3 Frequency: called by the Departmental Representative on an as-needed basis.

.4 Location: as agreed to between the Departmental Representative and Contractor.

.5 Attendees: same as construction progress meetings.

.6 Meeting Chaired By: Departmental Representative.

.7 Agenda:

.1 Review and approval of minutes of previous meeting.

.2 Review of progress of Contract Deficiency correction.

.3 Identification of problems impeding Contract Deficiency correction.

.4 Review of outstanding Contract Deficiencies.

.5 Other business.

.8 Minutes: same as construction progress meetings.

END OF SECTION

Part 1 Construction Progress Schedule

.1 Form of Schedule:

.1 Horizontal bar chart of sufficient size to clearly indicate all required information.

.2 Divide time into months, weeks and days. Identify first work day of each week.

.3 Allow space for revisions.

.2 Content of Schedule:

.1 List all required utility and other systems shutdowns that will disrupt the normal operation of the Institution. (i.e. water, electricity, control system, fire alarm system, etc.). Provide a notification buffer of seven (7) calendar days prior to any shutdown.

.2 List and provide a separate bar for each activity. Include the following activities:

.1 Fire pump changeover.
.2 Tower Main storage tank level control changeover.
.3 Fire Alarm system interconnection.
.4 Fire pump Power Connection.
.5 Fire Hydrant Replacements.

.3 Indicate start and completion dates for each.

.4 Substantial Performance.

.5 Final Completion.

.6 Indicate projected percentage of completion for each activity as of first day of each month.

.7 Include a separate bar, coordinated with sub-schedules, for Contractor Start-Up for:

.1 Each mechanical system specified in Divisions 23-25.

.2 Each electrical system specified in Division 26.

.8 Include a milestone to mark commencement of Contractor Start-Up program.

.9 Include separate bars for the Performance Testing and Fine Tuning sub-phases of Facility Start-Up.

.3 Progress Revisions:

.1 Keep schedule on-site and up-to-date for duration of Contract.

.2 Indicate actual progress of work.

.3 Indicate major changes in scope.

.4 Revise projections of progress and completion as required.

.4 Submissions:

.1 Within fifteen (15) days after date of commencement of Contract, submit a copy of an initial construction schedule for the Departmental Representative's review and acceptance at the pre-construction meeting.

.2 Revise and resubmit schedule as required by the Departmental Representative.

.3 Submit copy of updated schedule when requested by the Departmental Representative.

Part 2 Submittals Schedule

.1 Prepare a schedule of shop drawings, product data and samples which are proposed to be submitted during the course of the Contract.

.2 Submit Submittals Schedule for the Departmental Representative's review within fifteen (15) days after date of commencement of Contract.

.3 After review, the Departmental Representative may require submission of additional information or request that some proposed submittals not be submitted. Submittals not requested may not be processed or reviewed by the Departmental Representative.

.4 Submittals Schedule may be part of Construction Progress Schedule.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are coordinated.

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

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

.10 Keep one (1) reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta of Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow seven (7) days for Departmental Representative's review of each submission.

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

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

.7 Accompany submissions with transmittal letter, in duplicate, containing:

.1 Date.
.2 Project title and number.
.3 Contractor's name and address.
.4 Identification and quantity of each shop drawing, product data and sample.
.5 Other pertinent data.

.8 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.
.2 Supplier.
.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.
.2 Layout, showing dimensions, including identified field dimensions, and clearances.
.3 Setting or erection details.
.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit six (6) electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit six (6) electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within three (3) years of date of contract award for project.

.13 Submit six (6) electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit six (6) electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit six (6) electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit six (6) electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

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

.20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PSPC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's business address.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

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

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpg format, fine resolution monthly with progress statement and as directed by Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: four (4) locations.

.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: as directed by Departmental Representative.

1.6 CERTIFICATES AND TRANSCRIPTS

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

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION8

Part 1 Intent

.1 Submit to the Departmental Representative, for review, shop drawings and product data called for by the Contract Documents and for such other items as the Departmental Representative may reasonably request.

.2 Until submittal is reviewed, do not proceed with work involving the relevant product.

Part 2 Shop Drawings

.1 Shop drawings means technical data specially prepared for work of this Contract; including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form.

.2 Present shop drawings in a clear and thorough manner to appropriately illustrate the work.

.3 Identify field dimensions on drawings.

.4 Identify shop drawings by appropriate references to sheet, detail, schedule or room numbers.

.5 Maximum drawing size: 860 x 1120 mm.

.6 Leave a clear space of 100 mm x 75 mm on each sheet of shop drawings for placement of the Departmental Representative's review stamp.

.7 Submit one (1) set of mylars for each required shop drawing.

Part 3 Product Data

.1 Product data means standard printed information describing materials, products, equipment and systems; not specially prepared for work of this Contract, other than the designation of selections.

.2 Clearly mark product data to identify products.

.3 Manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and descriptive data will be accepted in lieu of shop drawings provided that:

.1 information not applicable to work of this Contract is deleted, and

.2 standard information is supplemented with information specifically applicable to the work of this Contract.

.4 Submit clear reproducible information as follows:

.1 One (1) copy when product data is submitted as:

.1 Data sheets larger than 216 mm x 355 mm. Submit mylars.

.2 Unbound data sheets 216 mm x 355 mm or smaller. Submit printed or photocopied sheets.

.2 Ten (10) copies when product data is submitted as follows:

.1 Information which cannot be duplicated using a photocopier with an automatic document feeder, such as bound or multi-fold information.

.2 Information containing photographs or other information that does not reproduce well on a commercial photocopier.

Part 4 Submittal Preparation

.1 Review, date and sign, shop drawings and product data, prior to submission.

.2 Determine and verify:

.1 Field measurements.
.2 Field construction criteria.
.3 Catalogue numbers and similar data.
.4 Conformance with Contract Documents.

.3 Coordinate each submittal with requirements of work and Contract documents. Individual drawings will not be reviewed until all related shop drawing and product data are available.

.4 Notify the Departmental Representative, in writing, on the submittal and at the time of submission, of deviations from requirements of Contract Documents.

Part 5 Submission Requirements

.1 Make submittals sufficiently in advance of date that reviewed submittals will be required and in such sequence as to cause no delay in the Work.

.2 Accompany submittals with transmittal letter, containing:

.1 Date.
.2 Project title and number.
.3 Contractor's name and address.
.4 Number of each shop drawing, product data and sample submitted.
.5 Other pertinent data.

.3 Submittals shall include:

.1 Date and revision dates.
.2 Project title and number.
.3 Name of:

.1 Contractor.
.2 Subcontractor.
.3 Supplier.
.4 Manufacturer.
.5 Name of detailer when details not prepared by Contractor, sub-contractor, or supplier.

.4 Contractor's stamp, initialed or signed, certifying review of submittal, verification of field measurements, and compliance with Contract Documents.

.4 Make corrections or changes to rejected submittals and resubmit, as specified for initial submission.

Part 6 Responsibility For Errors, Omissions And Deviations

.1 The Departmental Representative's review of submittals does not relieve Contractor from responsibility for errors and omissions, nor deviations from requirements of the Contract Documents.

Part 7 Reproduction Of Submittals

.1 After final review, the Departmental Representative will reproduce at his expense, the number of copies he requires, and return reviewed reproducible documents. Contractor shall reproduce at his expense the number of copies required for performance of the Work.

END OF SECTION

Part 1 Contractor Start-Up Report

.1 Provide Contractor Start-Up report forms for the following:

.1 Each mechanical system specified in Divisions 21, 22, 23, and 25.
.2 Each electrical system specified in Division 26.

.2 A set of proforma Contractor Start-Up report forms are available from the Departmental Representative. These forms may be used in preparation of system reports. Modify the proforma forms and create new forms as required to provide a complete set of start-up report forms.

.3 Contractor may use his own start-up forms provided that they comply with specified requirements of Contractor Start-Up program.

.4 Include Manufacturer's equipment start-up reports, test certificates and balancing reports under the appendix to the Contractor Start-Up report.

.5 Provide an index of the start-up report content and a sub-index for each system category. Include divider tabs for each system category and sub-tabs for each individual system. Similarly provide an index and divider tabs to organize the report's appendix.

.6 Preface each system in the report with:

.1 A list of equipment that makes up the system.

.2 Adjacent to the list of equipment, include columns to indicate status of equipment operation, to date and to sign off equipment start-up.

.3 Space to record equipment and operational problems which cannot be corrected within the scheduled Contractor start-up program, and which may delay Interim Acceptance of the Work.

Part 2 Submissions

.1 Submit draft of project specific Contractor Start-Up report forms for the Departmental Representative's review and comment within three (3) weeks after date of commencement of Contract. Coordinate requirements for draft document with the Departmental Representative. Draft Contractor Start-Up report forms shall be complete with blank manufacturer's equipment start-up forms, test certificates and balancing reports.

.2 Submit final Contractor Start-Up report forms to the Departmental Representative no later than four (4) weeks after receipt of the Departmental Representative's review and comments on draft submission.

.3 Submit Contractor Start-Up reports, complete with all data entered, prior to Interim Acceptance of the Work.

END OF SECTION

Part 1 Intent

.1 Due to the nature of the facility where the Work is being performed, special procedures must be followed during the course of the Work.

.2 Comply with requirements specified in this Section and as otherwise determined by the Departmental Representative to maintain the required degree of security and safety for the User, Contractor's Personnel, Departmental Representative's personnel and the public.

Part 2 Definitions

.1 User: means facility inhabitants and staff.

.2 "CSC" means Correctional Service Canada.

.3 "Director" means Director, Warden or Superintendent of the Institution as applicable.

.4 User Representative: means the person designated in this Section.

.5 "Perimeter" means the fenced or walled area of the Institution that restrains the movement of the inmates.

.6 Contractor's Personnel: means all members of Contractor's work force, all members of Subcontractors' and Sub-subcontractors' work forces, and all other persons who require access to the facility for performance of the Work.

.7 "Contraband" means:

.1 An intoxicant, including alcoholic beverages, drugs and narcotics.

.2 Tobacco or associated tobacco products.

.3 An igniting device, lighter or matches.

.4 A weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization.

.5 An explosive or a bomb or a component thereof.

.6 Currency over $25.00 when possessed by an inmate without prior authorization.

.7 Any item not described in paragraphs 1.2.1.1 to 1.2.1.6 that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.

Part 3 User Representative

.1 The facility's contact person with respect to requirements of this Section and all other facets of the Work, which directly or indirectly affect the operation of the facility, will be:

Name:	Shaun Lumsden
Position (company):	Drumheller Institution
E-mail:	Shawn.Lumsden@pwgsc-tpsgc.gc.ca

or any other person whom the Director of the facility may designate from time to time. This person is called the "User Representative" for the purposes of this Contract. If the User Representative is changed, the Contractor will be notified accordingly.

.2 The User Representative is **not** a representative of the Departmental Representative.

.3 The Contractor's contact and all communication shall, in the first instance, be with the Departmental Representative who will in turn communicate with the User Representative.

.4 The Contractor may communicate directly with the User Representative **only** if:

.1 a concern arises which affects the operation of the facility, and

.2 such concern requires prompt attention, and

.3 the Departmental Representative cannot be contacted.

.5 Acceptance of any instructions given by the User Representative under circumstances indicated above, shall be at the Contractor's discretion and at his own risk.

.6 Notwithstanding the foregoing, in the event of an emergency involving security or safety, the Contractor shall comply immediately with all instructions given by the User Representative.

Part 4 Pre-Construction Briefing

.1 The Contractor and all Contractor's Personnel shall allow a minimum of three (3) hours for a pre-construction briefing by the Departmental Representative and the User's Representative.

.2 Only those persons who have attended a pre-construction briefing are permitted to commence work in the facility.

Part 5 Entry and Identification

.1 Upon each entry to the site, Contractor's Personnel shall contact appropriate facility staff and identify themselves.

.2 Entrance may entail issuance of identification cards or badges, notation in a log book or other security procedures.

.3 Identification badges, if issued, must be worn at all times while on site.

Part 6 Security and Safety Regulations

.1 Comply with all security and safety regulations in force at the facility, at the Contractor's cost.

.2 Be aware of and comply with the facility's standing orders in case of fire and other emergencies.

.3 Contractor's Personnel shall confine themselves to their particular duties and areas of work and shall not converse nor fraternize with facility inhabitants.

Part 7 Vehicle Access and Parking

.1 Restrict construction traffic to access routes designated by the Departmental Representative. Obtain the Departmental Representative's permission before using alternative routes.

.2 Place directional signs along designated traffic route, to the Departmental Representative's satisfaction.

.3 Restrict loading and unloading operations to areas designated by the Departmental Representative.

.4 Restrict parking for Contractor's Personnel to areas designated by the Departmental Representative.

.5 Maintain parking areas in good condition during construction period. After completion of Work, restore parking areas to condition equal to that at start of the Work.

Part 8 Vehicle Operation and Security

.1 Observe posted speed limits and other traffic control signs on facility grounds.

.2 Do not leave any vehicle running and unattended, regardless of how long the operator intends to be absent from the vehicle.

.3 Do not leave keys in any unattended vehicle. Secure vehicles left unattended.

.4 Do not park vehicles in fire lanes or access areas unless absolutely necessary for the purpose of carrying out the Work.

.5 Secure vehicles left on site after normal working hours or overnight. Leave in designated parking area only.

.6 Secure tools, ladders, materials etc. when left in or on vehicles. Secure tools out of sight, not in passenger compartment of vehicle.

Part 9 Barriers

.1 Enclose and secure work area with barriers as specified in Section 01 50 00. Locate barriers as designated by the Departmental Representative.

.2 Ensure work area gates and accesses are locked and secured at end of each work day.

Part 10 Key Control

.1 Contractor's Personnel will be held personally responsible and accountable for key control.

.2 All security keys, including padlock keys, switch box keys and other keys must be accounted for at all times.

.3 Each person authorized to be in possession of keys must retain possession of such keys at all times while on-site. Unauthorized exchanges of keys among other Contractor's Personnel, Departmental Representative's personnel or facility staff is not permitted.

.4 Keys must never be given to an facility inhabitant or left in an area where an facility inhabitant could have access to a key.

Part 11 Tools, Equipment and Material Control

.1 Contractor's Personnel will be personally responsible and accountable for tools carried onto the site, upon entry and upon departure each work day, and upon completion of the Work.

.2 Tools carried into an inhabited secure area must be accounted for, upon entry to and upon departure from such areas.

.3 All tools must be permanently marked with the Departmental Representative's name.

.4 The Departmental Representative may request that an inventory be provided of a tradesman's personal tools and may inspect such tools at any time to confirm count.

.5 Maintain visual control of, and closely monitor use and location of, tools, equipment and materials at all times. Keep tools in immediate work area.

.6 Do not leave tools and equipment unattended at any time without being shut off and properly secured.

.7 Leave tools, equipment and materials in a secure storage area or otherwise secured to the Departmental Representative's satisfaction when not is use during the work day and at the completion of each work day.

.8 Tools that present a high security risk, such as saws, hammers, chisels, screw drivers, power nail drivers, crowbars, etc., must be removed from work areas upon the completion of each work day.

.9 Use of explosive actuated fastening devices is prohibited.

.10 Do not deposit or allow to accumulate outside confines of work area, unused and waste material, rubbish, and debris, including nails, screws, etc. Remove material so deposited from site immediately.

Part 12 Procedures In Event Of Loss

.1 If a key, tool, piece of equipment or item of personal property is lost or missing, or there is an unexplained material shortage, take the following action immediately:

.1 Notify appropriate facility staff or User Representative and advise them of the loss. Do not attempt to search for the lost item(s) prior to this notification.

.2 Provide facility staff with as much detail about the lost item as possible, including where it was lost and for how long it has been missing.

.3 Account for all other keys, tools, equipment and materials.

Part 13 Shipments

.1 All shipments of project material, equipment and tools shall be addressed in the Contractor's name to avoid confusion with the Institution's own shipments. The Contractor must have his/her own employees on-site to receive any deliveries or shipments. CSC staff will NOT accept receipt of deliveries or shipments of any material, equipment or tools.

Part 14 Telephones

.1 There will be no installation of telephones, facsimile machines and computers with Internet connections permitted within the perimeter of the Institution unless prior approval of the Director is received.

.2 The Director will ensure that approved telephones, facsimile machine and computers with internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an internet connection to unauthorized personnel.

.3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, telephone used as 2-way radios, are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.

.4 The Director may approve but limit the use of 2-way radios.

Part 15 Work Hours

.1 Normal work hours within the Institution are: Monday to Friday 07:30 a.m. to 4:00 p.m. Special arrangements with the Institution's CPM (Chief of Plant Maintenance) will be required for overnight work as described in Section 01 11 00 - 1.7.2.

.2 Work will not be permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven (7) days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Director.

Part 16 Overtime Work and Overnight Work

.1 No overnight or weekend work will be allowed AND OVERNIGHT WORK without permission of the Director. Give a minimum forty-eight (48) hours advance notice when overnight or weekend work on the construction project is necessary and approved.

.2 When overnight work, weekend, or statutory holiday work is required and approved by the Director, extra staff members may be posted by the Director or his/her designate, to maintain the security surveillance.

.3 For overnight work as described in this specification for replacement of circuit breakers, feeders and distribution panels, extra security staff, if required, will be paid for by the Departmental Representative.

Part 17 Prescription Drugs

.1 Employees of the contractor who are required to drugs take prescription drugs during the work day shall obtain approval of the director to bring a one (1) day supply only into the Institution.

Part 18 Contraband

.1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.

.2 Discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the director

.3 Contractors shall be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the institution for the duration of the construction.

.4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

Part 19 Contact With Inmates

.1 Unless specifically authorized, it is forbidden inmates to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his/her security clearance revoked.

.2 It is forbidden to take pictures of inmates, of CSC staff members or of any part of the institution other than those required as part of this contract.

END OF SECTION

Part 1 Work Site Safety – Property Management Contractor Is "Prime Contractor"

.1 For the purposes of the *Occupational Health and Safety Act* (Alberta), the "prime contractor" for the "work site" will be the property management contractor, which is:

.1 Company name.

.2 Comply with the Act and its regulations, as required, to ensure the health and safety of all persons at the "work site".

.3 Cooperate with, and comply promptly with any directives of, the property management contractor on safety related matters.

.4 Safety certification, as specified in Division 02 - Instructions to Bidders, is a condition of contract award.

.5 The Contractor shall maintain a valid standard COR, SECOR, COREL, or TLC for the duration of the Work of this Contract.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.2 Province of Alberta

.1 Occupational Health and Safety Act, R.S.A. - Updated June 2018.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit four (4) copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.

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

.5 Submit copies of incident and accident reports.

.6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within two (2) days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within two (2) days after receipt of comments from Departmental Representative.

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

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

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

1.3 FILING OF NOTICE

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

.2 Work zone locations include:

.1 Boiler and Electrical Rooms.

.3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

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

1.7 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Inmates.

1.8 GENERAL REQUIREMENTS

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

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

1.9 RESPONSIBILITY

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

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act, General Safety Regulation, Alberta.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

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

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety coordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY COORDINATOR

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

.1 Have working knowledge of occupational safety and health regulations.

.2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.4 Be on-site during execution of Work and report directly to and be under direction of site supervisor.

1.13 POSTING OF DOCUMENTS

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

1.14 CORRECTION OF NON-COMPLIANCE

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

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

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

1.15 POWDER ACTUATED DEVICES

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

1.16 WORK STOPPAGE

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

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 Definitions

.1 Regulatory requirements mean: laws, by-laws, ordinances, rules, regulations, codes, orders of Authorities Having Jurisdiction, and other legally enforceable requirements applicable to the Work and which are or become in force during the performance of the Work.

Part 2 General

.1 Comply with regulatory requirements.

.2 Except as otherwise specified, apply for, obtain, and pay all fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and the Contract Documents, based on:

.1 regulatory requirements and fees in force on date of tender submission, and

.2 any change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given prior to date of tender submission.

.3 Contractor shall give all notices required by regulatory requirements.

Part 3 Contract Documents

.1 Contractor shall not be responsible for verifying that Contract Documents comply with regulatory requirements. If Contract Documents are at variance therewith, or changes which require modification to Contract Documents are made to regulatory requirements, by Authorities Having Jurisdiction, subsequent to date of tender closing, Contractor shall notify the Departmental Representative in writing, requesting direction, immediately such variance or change becomes known to him. The Departmental Representative may make changes required to Contract Documents, and any resulting change in Contract Price or Contract Time will be made in accordance with the General Conditions of Contract.

.2 If Contractor fails to notify the Departmental Representative in writing and obtain the Departmental Representative's direction as required in paragraph 3.1 and performs work knowing it to be contrary to regulatory requirements, Contractor shall be responsible for and shall correct violations thereof and shall bear costs, expenses and damages attributable to his failure to comply with provisions of such regulatory requirements.

Part 4 Alberta Building Code

.1 Conform to and perform work in accordance with the National Building Code, except as otherwise indicated in Contract Documents.

Part 5 Permits

.1 Development Permit: The Departmental Representative will apply for, obtain, and pay for development permit if required.

.2 Building Permit:

.1 Contractor shall apply for, obtain and pay for building permit and other permits required for the Work and its various parts.

.2 Contractor shall display the building permit and such other permits in a conspicuous location at the Place of the Work.

.3 Occupancy Permits:

.1 Where required by authority having jurisdiction, Contractor shall apply for, obtain, and pay for occupancy permits, including partial occupancy permits.

.2 Where Contract Document deficiencies are required to be corrected in order to obtain occupancy permits, including partial occupancy permits, the Departmental Representative will issue appropriate instructions to correct the Work.

.3 Turn occupancy permits over to the Departmental Representative.

END OF SECTION

Part 1 Testing By Contractor

.1 Contractor shall furnish to the Departmental Representative, upon request, test results from testing performed by Contractor.

.2 Tests or inspections as required to verify acceptability of work, shall be paid for by Contractor.

Part 2 Testing By Departmental Representative

.1 The Departmental Representative reserves the right to employ services of independent testing agencies to establish if work complies with Contract Documents. The Departmental Representative will appoint and pay for services of such testing agency.

.2 Where tests or inspections, by the Departmental Representative appointed testing agency, indicate work is not in accordance with the Contract Documents, additional tests or inspections, as the Departmental Representative may require, to verify acceptability of corrected work, shall be paid for by Contractor.

Part 3 Inspection of Lines and Levels

.1 When the setting out of main lines for the building is complete, and floor elevations established, request the Departmental Representative, in writing, to inspect this work.

.2 Do not proceed with any further work until this inspection is made and confirmed in writing.

Part 4 Reference Standards

.1 Within the text of these specifications, reference may be made to the following standards:

.1 ANSI - American National Standards Institute
.2 ASTM - American Society for Testing and Materials
.3 CGSB - Canadian General Standards Board
.4 CSA - Canadian Standards Association
.5 CAN - National Standard of Canada (published by CGSB)
.6 FM - Factory Mutual Engineering Corporation
.7 ULC - Underwriters Laboratories of Canada

.2 The referenced standard and any amendments in force on the day of receipt of bids shall be applicable to the work during the duration of the Contract.

END OF SECTION

Part 1 Intent

.1 Provide temporary facilities and controls specified in this Section and as otherwise required for performance of work of the Contract.

Part 2 Reference Documents

.1 Canadian General Standards Board (CGSB):

.1	CAN/CGSB 1.189-00	Exterior Alkyd Primer for Wood
.2	CGSB 1.59-97	Alkyd Exterior Gloss Enamel

.2 Canadian Standards Association (CSA):

.1	CSA-A23.1/A23.2-04	Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
.2	CSA-0121-M1978(R2003)	Douglas Fir Plywood
.3	CAN/CSA-S269.2-M1987 (R2003)	Access Scaffolding for Construction Purposes
.4	CAN/CSA-Z321-96 (R2001)	Signs and Symbols for the Occupational Environment

.3 U.S. Environmental Protection Agency (EPA) / Office of Water:

.1	EPA 832R92005	Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices

Part 3 Submittals

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

Part 4 Field Offices and Sheds

.1 Contractor's Office: Provide and maintain, during the entire progress of the work, a suitable office on the site, for own use, with suitable tables or benches for the examination of drawings, specifications, etc., and where all notices and instructions from the Departmental Representative may be received and acknowledged.

.2 Materials Storage: Provide suitable weather and waterproof storage buildings for the storage and protection of materials. These buildings shall be under lock and key maintained in good condition until the completion of the building.

.3 Materials Storage: There will be no on-site materials storage on this project. Contractor will be responsible for the procurement and payment of all off-site storage. Materials are to be brought to the site only immediately prior to their incorporation into the Work.

Part 5 Utilities

.1 Sanitary Facilities: Contractor to provide their own 'port a potty' so that access to inmate areas will not be required.

.2 Water Supply: Contractor will be permitted use of existing water supply, for construction purposes, at no cost to the Contractor. Contractor shall be responsible for all connections, disconnections, service lines, valves, etc., required to provide service and removal of same to the satisfaction of the Departmental Representative upon completion of the Work.

.3 Temporary Light and Power: Contractor will be permitted use of existing light and power for construction purposes at no cost to the Contractor. Contractor will be responsible for all connections, disconnections, switches, service lines, etc., and removal of same upon completion of the Work.

.4 Contractor shall bear costs of all temporary services required for the project in excess of those, available from existing services, supplied by the Departmental Representative.

.5 Supply, erect and maintain barricades, sidewalk sheds, catch platforms, and accessories as required by authorities having jurisdiction. When no longer required, remove from the site. Demolished material shall become property of Contractor.

Part 6 Construction Aids

.1 Appliances and Scaffolding: Furnish all necessary transportation, scaffolding, forms, labour, tools and mechanical appliances, machinery, services and material required for executing the work.

Part 7 Protection of The Public and Fire Safety

.1 Comply with requirements of the National Building Code, Part 8, except as specified otherwise.

.2 Provide and maintain temporary fire protection equipment during performance of Work required by the Departmental Representative in accordance with governing codes, regulations, and bylaws.

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

Part 8 Security

.1 Provide and pay for responsible security personnel, acceptable to the Departmental Representative, to guard site and contents of site after working hours and during holidays.

.2 Equip exterior temporary doors with hardware and locks.

.3 Secure building against illegal entry at end of each work day.

Part 9 Activities Generating Vibration, Noise or Safety Concerns

.1 Operations considered by the Departmental Representative to generate vibration, noise or safety concerns include, but are not limited to, the following:

.1 Cutting and coring of concrete.

.2 Use of power actuated fasteners.

.2 Do the following when work generating vibration, noise or safety concerns may affect user or user operations.

.1 Coordinate with the Departmental Representative and user representative.

.2 Schedule and coordinate hours of work with user representative.

.3 Stop operations generating vibration, noise or safety concerns when instructed verbally or in writing by the Departmental Representative. Do not resume such operations until authorized by the Departmental Representative.

Part 10 Preventing Mould During Construction

.1 Monitor interior relative humidity conditions in relation to surface temperatures to prevent generation of moisture that may contribute to mould growth on the surface of organic construction materials.

.2 If using temporary heaters, use a type that exhausts combustion products directly to the exterior of building enclosures. Do not use temporary heaters that exhaust combustion products into building enclosures.

.3 Install insulation concurrently with air and vapour retarder.

.4 Protect all organic construction materials from the elements, before, during, and after their installation.

.5 Refer to CCA 82 - 2004 "Mould Guidelines for the Canadian Construction Industry", published by the Canadian Construction Association, for additional information about mould, its implications and recommendations on its prevention.

.6 Promptly report to the Departmental Representative any mould growth observed at the work site. If the Departmental Representative determines that such mold growth was caused by the Contractor's operations, the Contractor shall promptly remove it in accordance with procedures prescribed by the Departmental Representative, at no cost to the Contract.

Part 11 Cleaning During Construction

.1 At regular intervals during progress of work, clean-up building premises and site and dispose of waste material, rubbish, and debris.

.2 Do not allow waste material, rubbish, and debris to accumulate and become an unsightly or hazardous condition. Maintain site in a clean and orderly condition.

.3 Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

.4 Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.5 Sprinkle dusty debris with water as required.

.6 Lower waste material in a controlled manner; do not drop or throw materials from heights.

.7 Clean interior building areas prior to commencement of site painting and finishing operations and continue cleaning on an as-needed basis and to eliminate dust, until building is ready for occupancy.

.8 Ensure that each Subcontractor engaged on the Work bears his full responsibility for cleaning up during and upon completion of his work in accordance with provisions of this article.

Part 12 Waste Disposal Requirements

.1 Comply with Provincial and Municipal laws, rules and regulations pertaining to disposal operations.

.2 Provide on-site metal containers with lids, for collection and temporary storage of waste material, rubbish, and debris.

.3 Dispose of waste material, rubbish, and debris at disposal areas away from site.

.4 Do not burn or bury waste material, rubbish and debris on-site.

.5 Do not dispose of wastes into brooks, streams, rivers, waterways, lakes or ponds.

.6 Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

Part 13 Cleaning Of Streets And Sidewalks

.1 Take precautions to prevent depositing of mud or debris on roadways, sidewalks, and paved areas. Promptly clean-up any mud or debris so deposited.

.2 Neglect of these requirements will cause the Departmental Representative to have necessary clean-up work carried out and to charge all costs to Contractor.

Part 14 Removal and Restoration

.1 Remove temporary facilities specified in this Section, prior to request for inspection for Final Acceptance.

.2 Clean and repair damage caused by installation or use of temporary facilities. Restore existing facilities used during construction as specified to original condition.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978 (R2003), Douglas Fir Plywood.

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

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically flush and butt jointed.

.3 Provide two (2) lockable truck entrance gate and at least one (1) pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

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

.5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.

.6 Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide one (1) lockable truck gate. Maintain fence in good repair.

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

1.4 GUARD RAILS AND BARRICADES

.1 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

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

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

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

1.6 DUST TIGHT SCREENS

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

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

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule three (3) days prior to installation.

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

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 Submittals

.1 Comply with requirements specified in specification Section 01 33 00.

.2 Within fifteen (15) days of date of commencement of Contract, submit four (4) copies of the product list, complete with names of products and manufacturers for each item of work listed.

Part 2 Products List

.1 Departmental Representative's Review: The Departmental Representative will with reasonable promptness:

.1 Review the Contractor's submission and determine whether products and manufacturers named comply with requirements of Contract Documents.

.2 Notify the Contractor, in writing, of acceptance or rejection of products and manufacturers named.

.3 If requested in writing by the Contractor, provide details relating to non-compliance of products.

.2 Upon rejection of a Contractor proposed product the Contractor shall:

.1 Provide, at no additional cost to the contract, a product meeting the requirements of the Contract Documents, and acceptable to the Departmental Representative.

END OF SECTION

1. FROM: (Contractor) _____
(Name)

_____
(Address)

TO: Departmental Representative

PROJECT: **CDC Drumheller Institution CHP Fire Pump Replacement**

Drumheller, Alberta

Project Number: R.060837.001

2. It is understood that:

.1 This Products List forms part of the Contract Documents for the above project.

.2 Product names/model numbers and manufacturer's names are provided for the Items of Work listed.

.3 All Items of Work are not necessarily listed.

3. In submitting this Products List the Contractor represents that:

.1 Products and manufacturers named meet the applicable requirements of the Contract Documents.

.2 Substitutions, if any, in lieu of specified proprietary products, comply with applicable mechanical specification sections.

4. The following conditions apply to the Products List:

.1 The Departmental Representative will determine whether the named products and manufacturers meet requirements of the Contract Documents and shall have the right to reject named products and manufacturers that, in the Departmental Representative's opinion, do not meet such requirements.

.2 Departmental representative acceptance of a product or manufacturer, proposed by Contractor in Products List, shall not relieve Contractor from his responsibility to comply with Contract Documents, including the submission of shop drawings, product data and samples which may be required.

.3 Products and manufacturers accepted by the Departmental Representative shall be used in the performance of the Work and shall not be changed without the Departmental Representative's written consent.

5. Products specified by the proprietary method are indicated with an asterisk (*).

6. Products List:

Spec. Section Number	Item of Work	Product Name/Model No.	Manufacturer's Name

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Standard Acquisition Clauses and Conditions (SACC) Manual

.1 https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual.

.1 Departmental Representative's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

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

1.3 SURVEY REFERENCE POINTS

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

.2 Make no changes or relocations without prior written notice to Departmental Representative.

.3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

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

1.4 SURVEY REQUIREMENTS

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

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

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

1.5 EXISTING SERVICES

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

1.6 LOCATION OF EQUIPMENT AND FIXTURES

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

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

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

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

1.7 RECORDS

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

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

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

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

1.9 SUBSURFACE CONDITIONS

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

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

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Standard Acquisition Clauses and Conditions (SACC) Manual

.1 https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual.

1.2 PROJECT CLEANLINESS

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

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

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

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

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

.6 Provide and use marked separate bins for recycling.

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.3 FINAL CLEANING

.1 Refer to Standard Acquisition Clauses and Conditions (SACC) Manual.

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

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

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

.5 Remove waste products and debris including that caused by Departmental Representative or other Contractors.

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

.7 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

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

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

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

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

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

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

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

.15 Remove dirt and other disfiguration from exterior surfaces.

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

.17 Sweep and wash clean paved areas.

.18 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.19 Clean roofs, downspouts, and drainage systems.

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

.21 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PSPC's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and/or Demolition (CRD) waste to be project generated.

.2 PWGSC's waste management goal: to divert a minimum 75% of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.

.3 Target percentage goals are achievable for waste diversion. Contractor to review and confirm Departmental Representative's Waste Audit acceptable values.

.4 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.

.5 Protect environment and prevent environmental pollution damage.

1.2 REFERENCES

.1 Definitions:

.1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.

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

.3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities

.4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).

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

.6 Waste Source Separation Program (WSSP): implementation and coordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.

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

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

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

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

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

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

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

.13 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

.14 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.

.15 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.

.16 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating required submittal and reporting requirements.

.17 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

.2 Reference Standards:

.1 Public Services and Procurement Canada (PSPC)

.1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.

.2 CRD Waste Management Market Research Report (available from PSPC's Environmental Services).

.3 Sustainable Development Strategy 2007-2009: Target 2.1 Environmentally Sustainable Use of Natural Resources.

.1 Real Property projects over $1 million and in communities where industrial recycling is supported, implementation of CRD waste management practices will be completed, with waste materials being reused or recycled.

.2 Contractually ensure resources used in construction or maintenance are consumed and recovered in a sustainable manner.

1.3 DOCUMENTS

.1 Post and maintain in visible and accessible area at job site, one (1) copy of following documents:

.1 Waste Audit (Schedule A).

.2 Waste Reduction Workplan (Schedule B).

.3 Waste Source Separation Program.

.4 Schedules B completed for project.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:

.1 One (1) copy and one (1) electronic copy of completed Waste Audit (WA): Schedule A.

.2 One (1) copy and one (1) electronic copy of completed Waste Reduction Workplan (WRW): Schedule B.

.3 One (1) copy and one (1) electronic copy of Cost/Revenue Analysis Workplan (CRAW): Schedule E.

.4 One (1) copy and one (1) electronic copy of Waste Source Separation Program (WSSP).

.3 Prepare and submit on bi-weekly basis, throughout project or at intervals agreed to by Departmental Representative the following:

.1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.

.2 Updated Waste Materials Tracking form (Schedule D).

.3 Written bi-weekly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.

.4 Submit prior to final payment the following:

.1 Waste Diversion Report, indicating final quantities in tones by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials (see Schedule C).

.2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.5 WASTE AUDIT (WA)

.1 Departmental Representative will prepare WA prior to project start-up. WA will be provided with bid documentation (see Schedule A).

.2 WA provides detailed inventory, estimated quantities and types of waste materials that will be generated as well as their potential to be reused and/or recycled and project's waste diversion goals and objectives.

.3 After award of contract, contractor to review WA and confirm that anticipated quantities of waste generated are accurate and goals achievable.

.4 If after review, contractor determines that indicated quantities or opportunities in WA are not accurate or achievable, contractor to provide written details of discrepancies and revised quantities for areas of concern. Contractor to meet with Departmental Representative to review and justify revisions.

.5 Post on-site WA where contractor and sub-contractors are able to review content.

1.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare and submit WRW (Schedule B) at least ten (10) days prior to project start-up.

.2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.

.3 WRW should include but not limited to:

.1 Applicable regulations.

.2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.

.3 Destination of materials identified.

.4 Deconstruction/disassembly techniques and schedules.

.5 Methods to collect, separate, and reduce generated wastes.

.6 Location of waste bins on-site.

.7 Security of on-site stock piles and waste bins.

.8 Protection of personnel, sub-contractors.

.9 Clear labelling of storage areas.

.10 Training plan for contractor and sub-contractors.

.11 Methods to track and report results reliably (Schedule D).

.12 Details on materials handling and removal procedures.

.13 Recycler and reclaimer requirements.

.14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.

.15 Requirements for monitoring on-site wastes management activities.

.4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.5 Post WRW or summary where workers at site are able to review content.

.6 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project (Schedule D).

1.7 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Prepare CRAW (see Schedule E) and include the following:

.1 Cost of current waste management practices.

.2 Implementation cost of waste diversion program.

.3 Savings and benefits resulting from waste diversion program.

1.8 WASTE SOURCE SEPARATION PROGRAM (WSSP)

.1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.

.2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.

.3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.5 Locate containers to facilitate deposit of materials without hindering daily operations.

.6 Provide training for contractor, sub-contractors and workers in handling and separation of materials for reuse and/or recycling.

.7 Locate separated materials in areas which minimizes material damage.

.8 Clearly and securely label containers to identify types/conditions of materials accepted and assist contractor, sub-contractors and workers in separating materials accordingly.

.9 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.

.10 On-site sale of salvaged materials is not permitted unless authorized in writing by Departmental Representative and provided that site safety regulations and security requirements are adhered to.

1.9 USE OF SITE AND FACILITIES

.1 Execute Work with minimal interference and disturbance to normal use of premises.

.2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

1.10 WASTE PROCESSING SITES

.1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.11 QUALITY ASSURANCE

.1 After award of Contract, a mandatory site examination will be held for this Project for Contractor and/or sub-contractors responsible for construction, renovation demolition/deconstruction waste management.

.1 Date, time and location will be arranged by the Departmental Representative.

.2 Waste Management Meeting: Waste Management Coordinator is to provide an update on status of waste diversion and management activities at each meeting. Written bi-weekly Waste Diversion Report summary to be provided by Waste Management Coordinator (refer to the Waste Diversion Report form in Schedule C and Waste Materials Tracking form in Schedule D).

1.12 STORAGE, HANDLING AND PROTECTION

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

.2 Unless specified otherwise, materials for removal do not become Contractor's property.

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

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

.5 Protect structural components not removed and salvaged materials from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

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

.8 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

.9 Separate and store materials produced during project in designated areas.

.10 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.

.1 On-site source separation is recommended.

.2 Remove co-mingled materials to off-site processing facility for separation.

.3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

.4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.13 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

.3 Keep records of construction waste including:

.1 Number and size of bins.
.2 Waste type of each bin.
.3 Total tonnage generated.
.4 Tonnage reused or recycled.
.5 Reused or recycled waste destination.

.4 Remove materials on-site as Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.14 SCHEDULING

.1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products – Not Applicable

Part 3 Execution

3.1 APPLICATION

.1 Do Work in compliance with WRW and WSSP.

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

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

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

3.3 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

.2 On-site sale of salvaged, recovered, reusable, recyclable materials is not permitted.

3.4 WASTE DIVERSION REPORT

.1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:

.1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.

.2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.

.1 Supporting documentation.

.2 Waybills and tracking forms.

.3 Description of issues, resolutions and lessons learned.

END OF SECTION

Part 1 References

.1 Not Used.

Part 2 Submittals

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

Part 3 Delivery, Storage and Handling

.1 Protect packaging during delivery, storage and handling to prevent development of mould and mildew on packaging and on products.

.2 Request that suppliers provide cleaning materials to minimize packaging and equipment.

.3 Deliver materials in recyclable, or in reusable packaging, such as cardboard, wood paper, or reusable blankets which will be reclaimed by supplier or manufacturer for recycling.

Part 4 Cleaning Materials

.1 Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

Part 5 Final Cleaning

.1 Perform final cleaning operations specified herein prior to request for inspection for Interim Acceptance of the Work.

.2 Use experienced workers or professional cleaners for final cleaning.

.3 Remove grease, paint spots, dirt, dust, stains, labels, fingerprints and other foreign matter from interior and exterior surfaces; vacuum and dust behind grilles, louvres and screens; wash floor surfaces not otherwise finished; clean metal doors and frames; clean metal work; clean equipment; clean hardware; clean and polish glass on both sides; clean and polish mirrors.

.4 Repair, patch and touch-up marred surfaces to match adjacent finishes.

.5 Replace cracked and broken glass.

.6 Ensure that cleaning agents and methods do not remove finishes and permanent protective coatings on surfaces being cleaned. Follow manufacturer's printed maintenance requirements for cleaning.

.7 Broom clean or remove snow and ice from all exterior paved areas designed for pedestrian or vehicular traffic, including parking areas.

.8 Leave all surfaces in perfectly clean and unsoiled condition to the Departmental Representative's satisfaction.

Part 6 Waste Disposal Requirements

.1 Remove all waste generated during cleaning operations from site.

END OF SECTION

Part 1 Contract Acceptance Procedures

.1 Prior to requesting the Departmental Representative's inspection for Interim Acceptance, Contractor shall do the following:

.1 Ensure that the Work is ready for use for the purpose intended.

.2 Review Contract Documents and inspect Work to confirm that prerequisites to Interim Acceptance of Work have been fulfilled and that Work is ready for inspection for Interim Acceptance.

.2 Submit written request to the Departmental Representative for inspection for Interim Acceptance of the Work, certifying that prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed, corrected or submitted.

.3 Results of the Departmental Representative's inspection for Interim Acceptance will form initial Contract Deficiency list.

.4 Following inspection, the Departmental Representative will:

.1 issue a Letter of Interim Acceptance stating effective date of Interim Acceptance of the Work, with a copy of the Contract Deficiency list attached thereto, or

.2 advise Contractor that prerequisites to Interim Acceptance are not fulfilled and repeat inspection for Interim Acceptance as necessary.

.5 Upon issuance of Letter of Interim Acceptance, the Departmental Representative will assume responsibility for care, custody and control of the Work, including responsibility for:

.1 Facility operation, including all systems and equipment.
.2 Maintenance.
.3 Security.
.4 Property insurance.
.5 Utility costs.

.6 Prior to requesting the Departmental Representative's inspection for Final Acceptance, Contractor shall do the following:

.1 Ensure that the entire Work, except those items arising from the warranty provisions of the Contract Documents, has been performed to the requirements of the Contract Documents.

.2 Review Contract Documents and inspect Work to confirm that prerequisites for Final Acceptance of Work have been met and that Work is ready for inspection for Final Acceptance.

.7 Submit written request to the Departmental Representative for inspection for Final Acceptance of Work, including copy of the Departmental Representative's most recent Contract Deficiency list, and certifying that each Contract Deficiency has been corrected or otherwise resolved in a manner agreed to between the Departmental Representative and Contractor. List known exceptions, if any, in request.

.8 Following inspection, the Departmental Representative will:

.1 issue a Letter of Final Acceptance, stating effective date of Final Acceptance of Work, or

.2 advise Contractor of Contract Deficiencies which must be corrected prior to issuance of Letter of Final Acceptance.

Part 2 Final Cleaning

.1 Perform final cleaning prior to request for inspection for Interim Acceptance of the Work.

.2 Use experienced workers or professional cleaners for final cleaning.

.3 Remove grease, paint spots, dirt, dust, stains, labels, fingerprints and other foreign matter from interior and exterior surfaces.

.4 Repair, patch and touch-up marred surfaces to match adjacent finishes.

.5 Replace cracked and broken glass.

.6 Ensure that cleaning agents and methods do not remove finishes and permanent protective coatings on surfaces being cleaned.

.7 Broom clean or remove snow and ice from all exterior paved areas designed for pedestrian or vehicular traffic, including parking areas.

.8 Remove waste, surplus materials and temporary facilities from the site.

.9 Leave all surfaces in perfectly clean and unsoiled condition.

Part 3 Project Record Documents

.1 The Departmental Representative will provide a set of ozalid prints for record drawing purposes.

.2 Maintain project record drawings separate from construction drawings and record deviations from Contract Documents caused by site conditions and changes ordered by Departmental Representative. Mark changes in red coloured ink.

.3 Record the following:

.1 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

.2 Field changes of dimensions and detail.

.3 Changes made by change and field order.

.4 Submit project record drawings to Departmental Representative before or with request for inspection for Interim Acceptance.

Part 4 Operation and Maintenance Data

.1 Provide Departmental Representative with three (3) copies of operation and maintenance data, as called for in the Contract Documents, made up as follows:

.1 Bind data in vinyl hard cover, variable capacity, expanding binder with full metal hinge and slide lock mechanism for 215 x 280 mm size paper.

.2 Enclose title sheet, labelled "Operating and Maintenance Data Manual", project name, date and list of contents.

.3 Organize contents into applicable sections of work to parallel project specifications section break-down. Identify each section with tabs of laminated mylar plastic.

.2 Include the following information plus data specified.

.1 Maintenance instructions for finished surfaces and materials.

.2 Copy of hardware and paint schedules.

.3 Names, addresses and phone numbers of subcontractors and suppliers.

.4 Guarantees, warranties and bonds indicating:

.1 Name and address of project.

.2 Warranty/Guarantee/Bond commencement date and duration.

.3 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.

.4 Signature and seal of Contractor.

.5 Additional material/equipment used in project listed under various sections showing name of manufacturer and source of supply.

.3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturers' literature.

.4 Include one (1) complete set of reviewed shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.

.5 Submit operation and maintenance manuals before or with request for inspection for Interim Acceptance.

Part 5 Spare Parts and Maintenance Materials

.1 Deliver specified spare parts and maintenance materials before request for inspection for Interim Acceptance.

.2 Use unbroken cartons, or if not supplied in cartons, they shall be securely packaged. Clearly mark as to content.

.3 If applicable, identify colour, room number or area where materials are used.

END OF SECTION

Part 1 Summary of Process

.1 A Contract acceptance process shall be used to facilitate the Departmental Representative's acceptance of the Work. The process can be summarized as follows:

.1 Interim Acceptance of the Work:

.1 Fulfillment of prerequisites to Interim Acceptance.
.2 Inspection for Interim Acceptance.
.3 Issuance of Letter of Interim Acceptance.

.2 Final Acceptance of the Work:

.1 Fulfillment of prerequisites to Final Acceptance.
.2 Inspection for Final Acceptance.
.3 Issuance of Letter of Final Acceptance.

.3 Total Completion of the Work:

.1 Fulfillment of prerequisites to Total Completion.
.2 Inspection for Total Completion.
.3 Issuance of Letter of Total Completion.

Part 2 Partial Acceptance pf Work

.1 When partial utilization of the Work is required and Interim Acceptance, Final Acceptance or Total Completion of part(s) of the Work is a condition of such partial utilization, the applicable requirements specified in this Section shall apply to the part(s) of the Work to be utilized.

Part 3 Prerequisites To Interim Acceptance

.1 Prior to requesting the Departmental Representative's inspection for Interim Acceptance, Contractor shall do the following, not necessarily in order listed:

.1 Perform Contractor Start-Up activities as specified in Section 01 91 01.

.2 Obtain and submit evidence of compliance with regulatory requirements as specified in Section 01 41 00, including the following:

.1 Occupancy permit(s).
.2 Inspection/operating certificates.

.3 Remove from project site temporary facilities as specified in Section 01 50 00, along with construction tools, equipment, mock-ups and similar items.

.4 Complete starting of systems and equipment as specified in Section 01 91 05.

.5 Complete testing, adjusting and balancing of systems and equipment as specified in Section 01 91 10.

.6 Complete equipment and systems demonstration and instruction as specified in Section 01 79 00.

.7 Complete final cleaning as specified in Section 01 74 23.

.8 Submit project record documents as specified in Section 01 78 39.

.9 Submit operation and maintenance data as specified in Section 01 78 23.

.10 Provide spare parts and maintenance materials as specified in Section 01 78 43.

.11 Complete installation of architectural finish items, including all mechanical and electrical covers and trims.

.12 Ensure that all Contract Deficiencies which may affect operation of systems have been corrected.

.13 Ensure that the Work is complete and ready for use for the purpose intended.

.14 Review Contract Documents and inspect Work to confirm that prerequisites to Interim Acceptance of Work have been fulfilled and that Work is ready for inspection for Interim Acceptance.

Part 4 Inspection For Interim Acceptance

.1 Submit written request to the Departmental Representative for inspection for Interim Acceptance of the Work, certifying that prerequisites specified in Article 4. above have been fulfilled and specifying known exceptions in the form of a list of items to be completed, corrected or submitted.

.2 The Departmental Representative will within a reasonable time after receipt of Contractor's request:

.1 proceed with inspection, or

.2 advise Contractor that prerequisites are not adequately fulfilled.

.3 Results of the Departmental Representative's inspection for Interim Acceptance will form initial Contract Deficiency list.

Part 5 Interim Acceptance of The Work

.1 Following inspection, the Departmental Representative will:

.1 issue a Letter of Interim Acceptance stating effective date of Interim Acceptance of the Work, with a copy of the Contract Deficiency list attached thereto, or

.2 advise Contractor that prerequisites to Interim Acceptance are not fulfilled and repeat inspection for Interim Acceptance as necessary.

.2 Upon issuance of Letter of Interim Acceptance, the Departmental Representative will assume responsibility for care, custody and control of the Work, including responsibility for:

.1 Facility operation, including all systems and equipment.
.2 Maintenance.
.3 Security.
.4 Property insurance.
.5 Utility costs.

Part 6 Prerequisites To Final Acceptance

.1 Prior to requesting the Departmental Representative's inspection for Final Acceptance, Contractor shall do the following:

.1 Ensure that the entire Work, including the correction of all Contract Deficiencies, except those items arising from the warranty provisions of the Contract Documents, has been performed to the requirements of the Contract Documents.

.2 Review Contract Documents and inspect Work to confirm that prerequisites for Final Acceptance of Work have been met and that Work is ready for inspection for Final Acceptance.

Part 7 Inspection For Final Acceptance

.1 Submit written request to the Departmental Representative for inspection for Final Acceptance of the Work, including copy of the Departmental Representative's most recent Contract Deficiency list, and certifying that each Contract Deficiency has been corrected or otherwise resolved in a manner agreed to between the Departmental Representative and Contractor. List known exceptions, if any, in request.

.2 The Departmental Representative will within a reasonable time after receipt of Contractor's request:

.1 proceed with inspection, or

.2 advise Contractor that prerequisites are not adequately fulfilled.

Part 8 Final Acceptance of The Work

.1 Following inspection, the Departmental Representative will:

.1 issue a Letter of Final Acceptance, stating effective date of Final Acceptance of Work, or

.2 advise Contractor of Contract Deficiencies which must be corrected prior to issuance of Letter of Final Acceptance.

Part 9 Prerequisites To Total Completion

.1 The prerequisites to Total Completion of the Work are:

.1 Final Acceptance of the Work.

.2 Expiry of one (1) year warranty period, excluding extended warranties, if any.

.3 Items arising from the one (1) year warranty period required by the Contract Documents shall have been corrected by the Contractor.

Part 10 Inspection For Total Completion

.1 Just prior to end of one (1) year warranty period, the Departmental Representative will conduct an inspection for Total Completion.

Part 11 Total Completion of The Work

.1 Following inspection, the Departmental Representative will:

.1 issue a Letter of Total Completion, or

.2 advise Contractor of items which must be corrected prior to issuance of Letter of Total Completion.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one (1) week prior to contract completion with Contractor's representative and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify Project requirements.
.2 Review manufacturer's installation instructions and warranty requirements.

.2 Departmental Representative to establish communication procedures for:

.1 Notifying construction warranty defects.
.2 Determine priorities for type of defects.
.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two (2) weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four (4) final copies of operating and maintenance manuals in English.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

.1 Organize data as instructional manual.

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

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

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

.2 For each product or system:

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

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

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

.5 Typewritten Text: as required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative Departmental Representative one (1) 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.

.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.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 Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.

.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 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 Provide digital photos, if requested, for site records.

1.7 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Sections 01 45 00 - Quality Control and 01 91 13 - General Commissioning (Cx) Requirements.

.15 Additional requirements: as specified in individual specification sections.

1.8 MATERIALS AND FINISHES

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.1 Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional requirements: as specified in individual specifications sections.

1.9 MAINTENANCE MATERIALS

.1 Spare Parts:

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site location as directed; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.2 Extra Stock Materials:

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site location as directed; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.3 Special Tools:

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site location as directed; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

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

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.11 WARRANTIES AND BONDS

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

.2 Submit warranty management plan, thirty (30) days before planned pre-warranty conference, to Departmental Representative approval.

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

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

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

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

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

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

.8 Conduct joint four (4) month and nine (9) month warranty inspection, measured from time of acceptance, by Departmental Representative.

.9 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems.

.3 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one (1) year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.4 Contractor's plans for attendance at four (4) and nine (9) month post-construction warranty inspections.

.5 Procedure and status of tagging of equipment covered by extended warranties.

.6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

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

.11 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.12 WARRANTY TAGS

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

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 Intent

.1 Contractor shall obtain all specified operation and maintenance data. Using this data, Contractor shall prepare and submit operation and maintenance manuals as specified.

.2 Contractor shall prepare and submit operation and maintenance manual(s) for all other equipment, systems, materials, and finishes not included above.

Part 2 Description of Types of Operation and Maintenance Data

.1 Contractor Designed System Data: includes the following for systems designed by Contractor:

.1 System Design Criteria
.2 System and Controls Descriptions
.3 System and Controls Schematics
.4 Operating Instructions

.2 Installation Instructions: manufacturer's printed instructions describing manufacturer's recommended installation procedures.

.3 Operating Instructions: manufacturer's printed instructions describing proper operation.

.4 Equipment Identification: name plate information for each piece of equipment, on forms approved by the Department Representative.

.5 Maintenance Instructions: manufacturer's printed instructions describing manufacturer's recommended maintenance.

.6 Spare Parts Lists: parts lists and manufacturer's recommended spare parts.

.7 Suppliers and Contractors List: list of contractors and suppliers who supplied and installed equipment, systems, materials or finishes, organized by Division and system. Includes company name, address, and telephone number.

.8 Tag Directories: directory identifying tag number and equipment description and location.

.9 Drawings List: list of contract drawings.

.10 Shop Drawings: final reviewed shop drawings.

.11 Product Data: manufacturer's product data for equipment, systems, materials and finishes.

.12 Certifications: includes the following:

.1 Copies of inspection reports prepared by authorities having jurisdiction.
.2 Certified copies of test reports prepared by independent testing agencies.
.3 Any other certificates required by the Contract Documents.

.13 Warranties and Bonds: Department Representative's copy of manufacturer's warranties, maintenance bonds and service contracts.

.14 Reports: includes the following:

.1 Reports documenting the performance of tests required by the Contract Documents and the results of those tests.

.2 Documentation of other material, equipment or system related information required by the Contract Documents.

Part 3 Contractor Prepared Operation and Maintenance Manual(s)

.1 General Organization:

.1 Include the following in each volume:

.1 Title page.
.2 Table of contents. Identify volume number where listed information is located.
.3 Ten (10%) percent free space for additional data.

.2 Present textual information, schematics and data on 21.5 X 28 cm, 75 g/m2, white bond paper.

.2 Manual Contents Organization:

.1 For each major equipment, system, materials or finishes area, organize operation and maintenance data as follows:

.1 Operation Division: include the following, as applicable:

.1 System Design Criteria.
.2 System and Controls Descriptions.
.3 System and Controls Schematics.
.4 Operating Instructions.

.2 Maintenance Division: include the following, as applicable:

.1 Maintenance Tasks and Schedules.
.2 Spare Parts.
.3 Suppliers and Contractors.
.4 Tags and Directories.

.3 Contract Document Division: include the following, as applicable:

.1 Drawings List.
.2 Shop Drawings and Product Data.
.3 Certifications.
.4 Warranties and Bonds.
.5 Maintenance Brochures.
.6 Reports.

.3 Document Binding Methods:

.1 Standard 21.5 X 28 cm sheets: punch sheets to fit binder.

.2 Sheets up to 28 X 41.5 cm: punched and neatly folded to allow use without removing from binder.

.3 Drawings larger than 28 X 41.5 cm: insert drawings in sturdy vinyl envelopes with reinforced binding holes, open on one side and overall folded size not exceeding 21.5 X 28 cm. Do not punch holes in drawings.

.4 Binders:

.1 Commercial quality, fabric coated, hard covers attached to spine with metal piano hinges, three post, designed to accommodate 21.5 X 28 cm paper. Maximum 100 mm thick.

.2 Silk-screen project title and identification, in white, on front cover and spine of binder.

.3 Colour of Binder Fabric and:

.1 Mechanical: Blue, Ontario Buckram colour #OBV460.
.2 Electrical: Red, Ontario Buckram colour #OBV037.
.3 Architectural/Structural/Specialties: Dark Green, Ontario Buckram colour #OBV375.
.4 Binders containing multiple disciplines (Mechanical, Electrical and Architectural) Binder fabric to be Architectural fabric colour.

.5 Divider Tabs:

.1 Heavy weight coloured paper, mylar laminated with tab number and title printed on tab as follows:

.1 Main Divisions: White tabs, labelled with division name, two bank tab length.

.2 Sections of a Main Division: tabs of same colour as Binder fabric for Mechanical, Electrical or Architectural sections of a Main Division, labeled with section name, four bank tab length.

.3 Subsections: tabs of same colour as Binder fabric for Mechanical, Electrical or Architectural subsections, printed label, eight bank tab length.

Part 4 Submission of Operation and Maintenance Manual(s)

.1 Submit four (4) copies of completed Contractor prepared operation and maintenance manual(s) prior to Interim Acceptance of the Work.

END OF SECTION

Part 1 Designation of Project Record Documents

.1 Request from the Departmental Representative at commencement of the Work the following documents to be designated and retained as project record documents:

.1 One (1) copy of specifications manual(s):

.2 Two (2) complete sets of Drawings.

.3 One (1) set of all Addenda issued.

Part 2 Maintenance of Project Record Documents

.1 Store record documents in site office apart from documents used for construction.

.2 Label each document "PROJECT RECORD" in neat, large printed letters.

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

.4 Keep record documents available for inspection by the Departmental Representative.

Part 3 Recording Information on Project Record Drawings

.1 Record information on ozolid drawings.

.2 Use coloured erasable pencils to record information.

.3 Use different colours to record information pertaining to each major system.

.4 Record changes and variations from Contract Drawings concurrently with construction process. Do not conceal any work until required information is recorded.

.5 Legibly mark project record drawings to record actual construction, including:

.1 Measured depths of foundation elements in relation to finished first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances. Reference locations to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances concealed in construction. Reference to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes to equipment layout and services.

Part 4 Submission of Project Record Documents

.1 Submit balance of completed project record documents before or with application for Interim Acceptance of the Work.

.2 Submit with each submission a covering letter including:

.1 Date of Submission.
.2 Project Title, Plan No. and Centre Code.
.3 Contractor's name, address and telephone number.

END OF SECTION

Part 1 Source of Supply

.1 Provide spare parts manufactured by original equipment manufacturer.

.2 Provide maintenance materials identical to those installed.

Part 2 Delivery, Storage and Handling

.1 Deliver required items to the Place of the Work and store in temporary locations determined by Contractor or permanent locations designated by the Departmental Representative.

.2 Deliver and store items in original factory packaging or other securely packaged form.

.3 Identify, on carton or package, name of item, colour or part number, as applicable. Identify equipment, system, area, room no., etc. for which each item is intended.

.4 Maintain an inventory list of all items delivered. For each item, record description of item, quantity, and location where stored.

.5 Stored items shall remain in Contractor's care, custody, and control until Interim Acceptance of the Work. Protect stored items against theft or damage.

.6 Handle items as necessary, until stored in permanent locations designated by Departmental Representative.

Part 3 Acceptance

.1 Prior to requesting Departmental Representative's inspection for Interim Acceptance, do the following:

.1 Review Contract Documents and compare with inventory list to verify that all required items have been delivered.

.2 Verify that items listed on inventory list are in their designated storage locations.

.3 Inspect items to verify that they meet specified requirements and are in serviceable condition.

.4 Arrange for delivery of any missing items.

.5 Arrange for replacement of items not meeting specified requirements or not in serviceable condition.

.6 Provide the Departmental Representative with copy of inventory list indicating status of all required items.

.2 Review inventory list with the Departmental Representative during the Departmental Representative's inspection for Interim Acceptance.

.3 For items not delivered prior to Interim Acceptance of the Work, provide a duplicate copy delivery slip and obtain Departmental Representative's signature upon delivery. The Departmental Representative will only accept responsibility for care, custody, and control of items properly received and signed for.

Part 4 Schedule

.1 Provide spare parts and maintenance materials specified in the following Sections:

.1 Mechanical Spare Parts and Maintenance Materials: Section 23 00 23

END OF SECTION

Part 1 Contractor Led Seminars

.1 Contractor shall organize equipment and system seminars for the following:

.1 All Division 23 Mechanical equipment and systems

.2 Contractor shall chair the seminars and be responsible for the following, as specified in this Section:

.1 Preparation of agendas and outlines.
.2 Seminar organization.
.3 Explanation of design philosophy.
.4 Equipment presentations.
.5 System demonstrations.
.6 Seminar and demonstration questions.

Part 2 Agendas and Outlines

.1 Prepare agendas and outlines including the following:

.1 Equipment and systems which will be included in seminars.
.2 Name of companies and representatives presenting at seminars.
.3 Outline of each seminar's content.
.4 Time and date allocated to each system and item of equipment.

Part 3 Seminar Organization

.1 Coordinate content and presentations for seminars.

.2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.

.3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.

.4 Coordinate proposed dates for seminars with the Departmental Representative and select mutually agreeable dates.

.5 Prepare to digitally record demonstration and training sessions, including video and audio.

Part 4 Explanation of Design Philosophy

.1 Explain design philosophy of each system. Include following information:

.1 An overview of how system is intended to operate.
.2 Description of design parameters, constraints and operational requirements.
.3 Description of system operation strategies.
.4 Information to help in identifying and troubleshooting system problems.

Part 5 Equipment Presentations

.1 Present information dealing with equipment. Include following in presentations:

.1 Explanation of how equipment operates.
.2 Recommended preventative and routine maintenance.

.2 Digitally record demonstration and training sessions and provide to the Departmental Representative on clear and audible, good quality, DVD disks.

Part 6 System Demonstrations

.1 Demonstrate operation of equipment and systems. Include the following in demonstration:

.1 Start-up and shutdown.
.2 Operation.
.3 Scheduled and preventative maintenance.
.4 Troubleshooting.

.2 Demonstration may be conducted at time of original starting with the Departmental Representative's prior approval.

Part 7 Seminar and Demonstration Questions

.1 Be prepared to answer all questions raised by the Departmental Representative at demonstrations and seminars. If unable to satisfactorily answer questions immediately, provide written response within three (3) days.

END OF SECTION

Part 1 General

.1 A facility start-up process shall be used to bring the facility to a fully operational state, free of deficiencies, in the most efficient and timely manner achievable.

.2 This Section specifies the Contractor's and Departmental Representative's responsibilities during each of the following successive sub-phases of Facility Start-Up:

.1 Contractor Start-Up which leads to Interim Acceptance of the Work.
.2 Performance Testing which leads to Practical Completion of the Work.
.3 Fine Tuning which leads to Final Acceptance of the Work.

Part 2 Contractor Start-Up

.1 Contractor shall do the following during Contractor Start-Up, not necessarily in order listed:

.1 Start equipment and systems as specified in Section 01 91 05.

.2 Test, adjust and balance equipment and systems as specified in Section 01 91 10.

.3 Demonstrate equipment and systems as specified in Section 01 79 00.

.4 Complete and submit Contractor Start-Up reports including:

.1 Contractor's system and equipment start-up reports.
.2 Testing, adjusting and balancing reports.
.3 Manufacturers' equipment start-up reports.

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

.6 Correct Contract Deficiencies identified as a result of the foregoing and as may be identified by the Departmental Representative**.**

.7 Execute Change Orders issued by the Departmental Representative.

.8 Perform all other work and activities required for fulfillment of prerequisites to Interim Acceptance of the Work as specified in Section 01 77 20.

.2 The Departmental Representative will do the following during Contractor Start-Up.

.1 Carry out pre-interim inspections as necessary.

.2 Witness manufacturers' equipment start-up.

.3 Verify starting, testing, adjusting and balancing by Contractor.

.4 Review and approve Contractor Start-Up reports.

.5 Cooperate in systems and equipment demonstration and instruction.

.6 Initiate Change Orders as required.

.7 Verify correction of Contract Deficiencies by Contractor.

.8 Verify execution of Change Orders by Contractor.

.9 Perform other activities related to Interim Acceptance of the Work as specified in Section 01 77 20.

.3 The preceding will be carried out in an ongoing cycle of:

.1 Departmental Representative's inspections.

.2 Documentation of results.

.3 Diagnosis of problems.

.4 Correction of Contract Deficiencies and execution of Change Orders as required.

.5 Verification of results.

Part 3 Performance Testing

.1 Performance Testing will commence upon Interim Acceptance of the Work.

.2 The Departmental Representative will do the following during Performance Testing:

.1 Carry out a series of preplanned systems and equipment operating tests under conditions simulating, to the extent possible, full and partial operating loads.

.2 Record test results.

.3 Diagnose problems and determine whether they are the result of Contract Deficiencies.

.4 Initiate Change Orders as required.

.5 Repeat tests as required following correction of Contract Deficiencies and execution of Change Orders by Contractor and verify results.

.6 Perform other activities related to Practical Completion of the Work as specified in Section 01 77 20.

.3 Contractor shall do the following during Performance Testing:

.1 Correct Contract Deficiencies previously outstanding and those identified during Performance Testing.

.2 Execute Change Orders issued by the Departmental Representative.

.4 The preceding will be carried out in an ongoing cycle of:

.1 Performance testing.

.2 Documentation of results.

.3 Diagnosis of problems.

.4 Correction of Contract Deficiencies and execution of Change Orders as required.

.5 Verification of results.

Part 4 Fine Tuning

.1 Fine Tuning shall commence upon Practical Completion of the Work.

.2 Contractor shall do the following during Fine Tuning:

.1 Correct all Contract Deficiencies previously outstanding and those identified during Fine Tuning.

.2 Execute Change Orders issued by the Departmental Representative.

.3 Perform all other work and activities required for fulfillment of prerequisites to Final Acceptance of the Work as specified in Section 01 77 20.

.3 The Departmental Representative will do the following during Fine Tuning:

.1 Conduct user surveys and take environmental measurements as necessary to identify existing and potential problems.

.2 Initiate Change Orders as required.

.3 Perform other activities related to Final Acceptance of the Work as specified in Section 01 77 20.

Part 5 Seasonal Constraints

.1 Notwithstanding all-inclusive requirements specified in this Section, additional separate cycles of Contractor Start-Up, Performance Testing and Fine Tuning may be necessitated at a later time on equipment and systems whose full operation is dependent on seasonal conditions.

.2 Contractor's responsibilities with respect to such later Facility Start-Up activities shall be as specified in this Section.

Part 6 Partial Utilization of Work

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

END OF SECTION

Part 1 Intent

.1 Perform starting of each system and each item of equipment in accordance with the general requirements specified herein.

Part 2 Preparation

.1 Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during starting process.

.2 Coordinate sequence for starting of various equipment and systems.

Part 3 Manufacturers' Site Services

.1 When specified in Divisions 02-49, or when otherwise requested by the Departmental Representative, require manufacturer to provide authorized representative to be present at site to do the following:

.1 Inspect, check and approve equipment and systems installation prior to starting.

.2 Supervise placing equipment and systems in operation.

.3 Provide a written report verifying that equipment:

.1 has been properly installed and lubricated,

.2 is in accurate alignment,

.3 is free from any undue stress imposed by connecting lines or anchor bolts, and

.4 has been satisfactorily operated under load conditions.

Part 4 Starting

.1 Verify that each item of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, and other conditions affecting starting and operation.

.2 Take corrective action as necessary.

.3 Execute starting under supervision of Contractor's personnel and, when specified or requested by the Departmental Representative, manufacturer's authorized representative.

.4 Place equipment and systems in operation in proper sequence and in accordance with approved Contractor Start-Up sub-schedule.

END OF SECTION

Part 1 Intent

.1 Contractor shall be responsible for testing, adjusting and balancing of all:

.1 piped, ducted, wired and wireless services and systems, including all components and equipment forming part thereof, and

.2 manually and mechanically operated systems including all components and equipment forming part thereof.

.2 Contractor shall perform testing, adjusting and balancing with Contractor's qualified personnel, or employ and pay for a qualified organization to perform such services.

.3 Perform testing, adjusting and balancing after starting of equipment and systems.

.4 Provide personnel, operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

.5 Report to the Departmental Representative any deficiencies or defects noted during testing, adjusting and balancing, which cannot be promptly corrected.

Part 2 Preparation

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

.2 Verify that each systems and equipment installation is complete and in continuous operation.

.3 Verify ambient conditions.

Part 3 Testing, Adjusting and Balancing

.1 Testing: Perform tests to confirm compliance with requirements of Contract Documents. Take corrective action as necessary.

.2 Adjusting: Perform adjustments to ensure proper, efficient and safe operation.

.3 Balancing: Perform balancing to ensure that the various parts of system are in a proper state of equilibrium.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA Standard Z320-11 Building Commissioning Standard.

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Related Requirements

.1 Section 01 91 31 - Commissioning Plan.

.2 Section 01 91 33 - Commissioning Forms.

.3 Section 01 91 41 - Commissioning: Training.

.4 Section 21 05 05 - Common Work Results for Fire Suppression.

.5 Section 26 05 00 - Common Work Results for Electrical.

.3 Acronyms, abbreviations, and definitions:

.1 BoD: Basis of Design Documentation.

.2 BMM: Building Management Manual.

.3 CA: Commissioning Agent.

.4 Cx: Commissioning.

.5 Cx Issues Log: Commissioning Issues Log. This document is provided by the Departmental Representative and contains a record of the issues found during commissioning which are to be addressed by the contractor.

.6 Cx Plan: Commissioning Plan.

.7 EMCS: Energy Monitoring and Control Systems.

.8 GC: General Contractor (Prime).

.9 O&M: Operation and Maintenance.

.10 PI: Product Information.

.11 PV: Performance Verification.

.12 PR: Project Requirements.

.13 Subs: Subcontractors to the General Contractor.

.14 TAB: Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting, and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively tested with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: s per client's requirements or determined by designer, to meet Project functional and operational requirements.

.4 AFD managed projects the term Departmental Representative in Cx specifications to be interpreted as AFD Service Provider.

1.3 COMMISSIONING OVERVIEW

.1 Section 01 91 31 - Commissioning (Cx) Plan.

.2 For Cx responsibilities, refer to Section 01 91 31 - Commissioning (Cx) Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

.4 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built system is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.6 Departmental Representative will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx. Contractor is to correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Departmental Representative.

.1 Adequacy of provisions for Cx.
.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Coordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.
.2 Ensure installation of related components, equipment, sub-systems, systems are complete.
.3 Fully understand Cx requirements and procedures.
.4 Have Cx documentation shelf-ready.
.5 Understand completely design criteria and intent and special features.
.6 Submit complete start-up documentation to Departmental Representative.
.7 Have Cx schedules up-to-date.
.8 Ensure systems have been cleaned thoroughly.
.9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
.10 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than four (4) weeks after award of Contract:

.1 Name of Contractor's Cx agent.
.2 Draft Cx documentation.
.3 Preliminary Cx schedule.

.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least eight (8) weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least eight (8) weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.

.2 Departmental Representative to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Cx Authority, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide fourteen (14) days notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval by Departmental Representative.

.3 Arrange for Departmental Representative to witness tests.

.4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

.3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

.1 Notify Departmental Representative at least twenty-one (21) days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual or accepted simulated operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Departmental Representative within five (5) days of test and with Cx report.

1.23 EXTRAPOLATION OF RESULTS

.1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.24 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify up to 100% of reported results, unless specified otherwise in other sections.

.2 Number and location to be at discretion of Departmental Representative.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies are found.

.5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.25 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fail to receive Departmental Representative's, Cx Authority's, or Consultant's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.26 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.27 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.28 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.29 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.30 TRAINING

.1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.31 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.32 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.33 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.
.2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.34 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/-10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/-2% of recorded values.

1.35 DEPARTMENTAL REPRESENTATIVE'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 **Products – Not Applicable**

Part 3 **Execution – Not Applicable**

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

.2 Related Requirements

.1 See the Commissioning (Cx) Plan prepared by WSP Canada Inc. dated December 20, 2018.

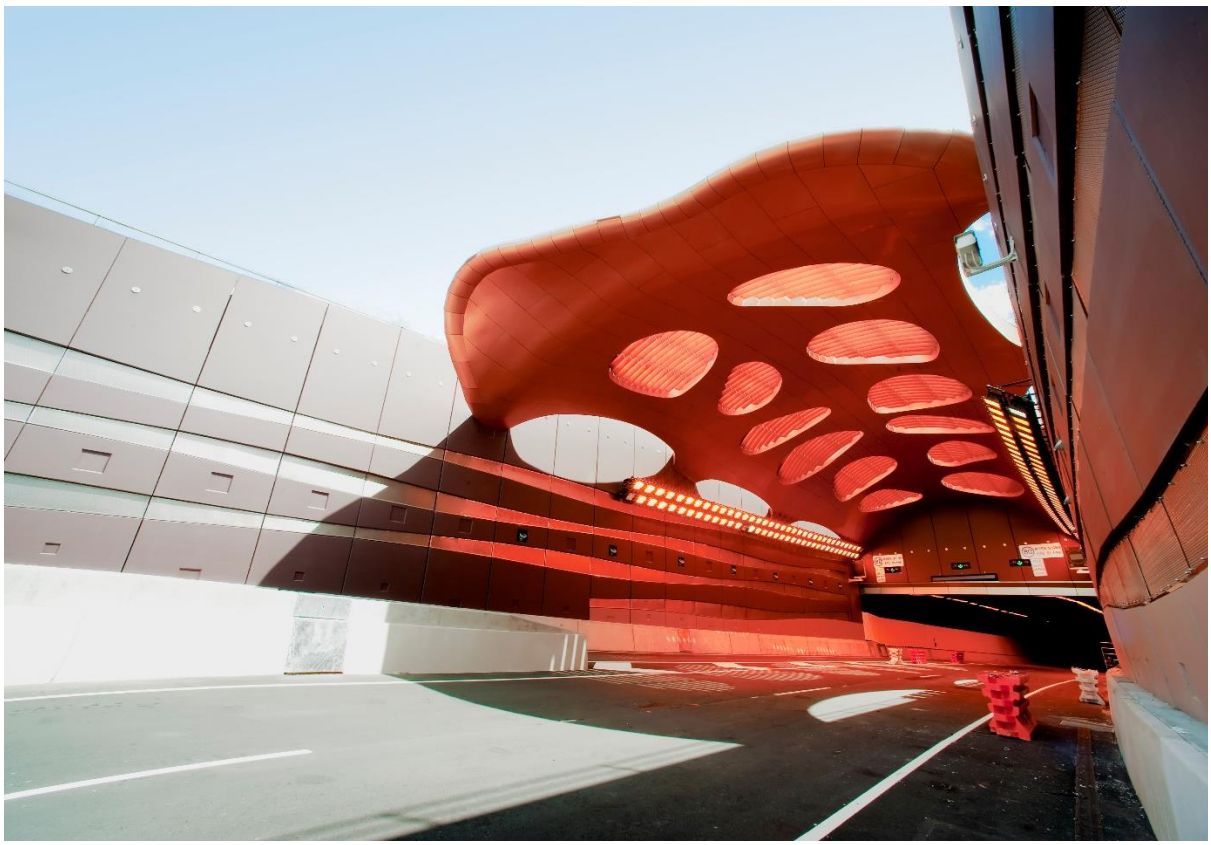
END OF SECTION

PUBLIC SERVICES AND PROCUREMENT CANADA (PSPC)/
CORRECTIONAL SERVICES CANADA (CSC)

CSC DRUMHELLER INSTITUTION CHP FIRE PUMP REPLACEMENT

COMMISSIONING PLAN

DECEMBER 20, 2018



QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3	REVISION 4
Remarks	SD Draft Cx Plan	SD Cx Plan	SD Cx Plan	SD Cx Plan	DD Cx Plan
Date	March 16, 2018	March 22, 2018	August 10, 2018	October 23, 2018	December 20, 2018
Prepared by	Mike Edwards	Mihir Shah	Mihir Shah	Mihir Shah	Mihir Shah
Signature					
Authorised by	Doug Cargill				
Signature					
Project number	R.060837.001 – 530-3204 (WSP # 181-01555-00)				

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1 SUMMARY

1.1 COMMISSIONING

Commissioning is the quality assurance process of moving the facility from the 'static completion' to the optimal 'dynamic' operating state. Building systems are checked for proper and complete installation, and then tested to verify proper functioning of both individual components and the total systems. The goal and overriding purpose is to verify that the building performs as per the design intent and meets the Owner's operational needs.

The Commissioning Plan provides the details for the implementation of the commissioning process.

- Outlines and describes the commissioning process and the objectives of the commissioning
- Identifies the members of the commissioning team and their roles and responsibilities in the commissioning process
- Documents the commissioning process for future references in operating and maintaining the facility
- Schedules the commissioning activities for testing, verification, and training of O/M staff

1.2 COMMISSIONING OBJECTIVES

- Support quality management through monitoring and checking of the installation.
- Verify system performance through testing and commissioning of the completed installation.
- Move the completed facility from the 'static completion' state to the optimal 'dynamic' operating state.
- Optimize operating and maintenance through delivery of comprehensive quality training and instruction to the Owner's operating personnel.
- System debugging and optimization.
- Completion of testing and verification through seasonal review.

1.3 REFERENCES

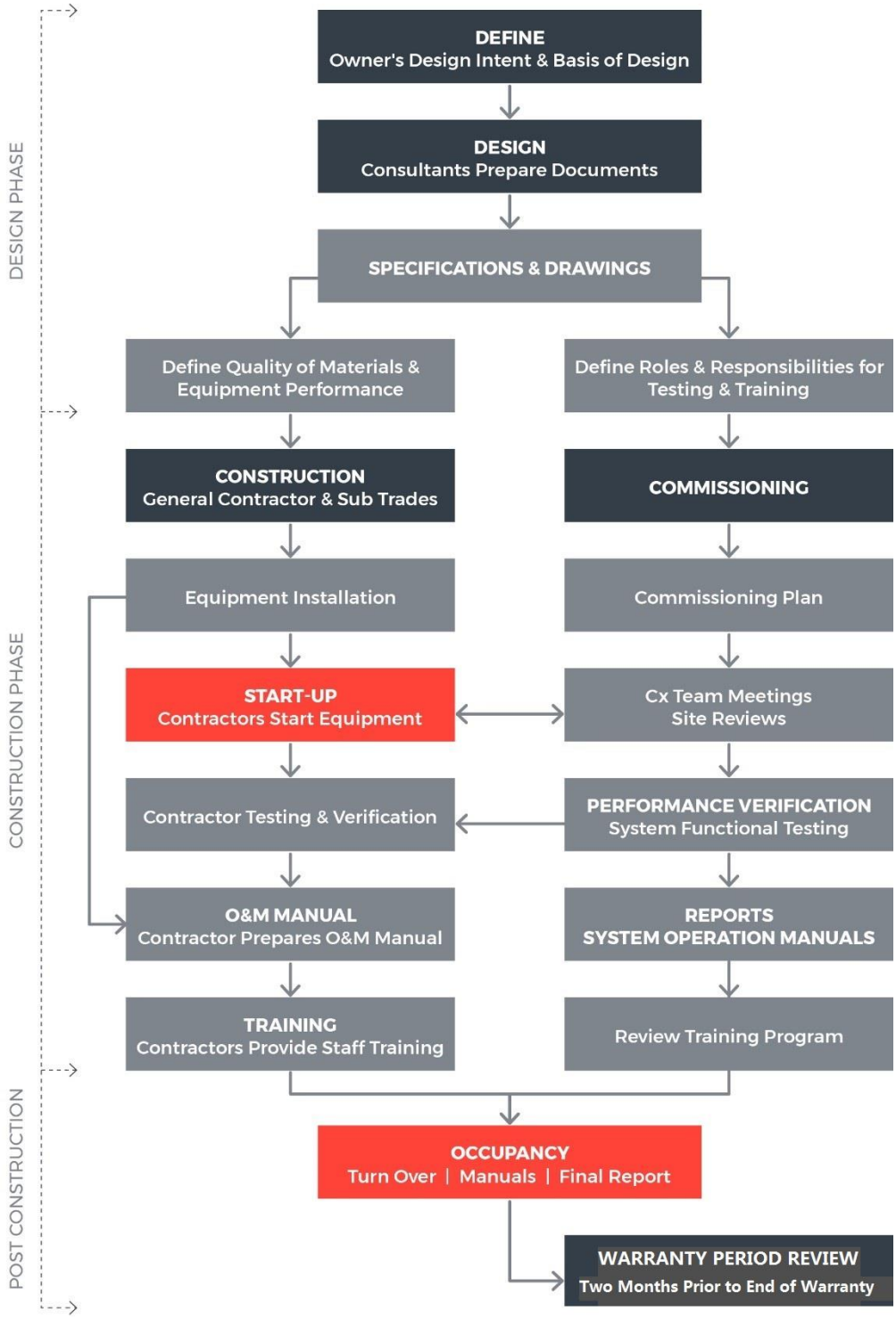
- Z320-11 (R2016) - Building Commissioning Standard.
- NFPA 4, Standard for Integrated Fire Protection and Life Safety System Testing.
- CAN/ULC-S1001-11 Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

2 COMMISSIONING PROCESS OVERVIEW

There are five main project phases, the concept design phase, design phase, construction phase, acceptance phase and post-acceptance phase. For each of these project phases, the various commissioning activities, and milestones are identified below.

The commissioning milestones are related to key events and deliverables throughout the commissioning process and are described fully in Section 3.

2.1 COMMISSIONING PROCESS FLOW CHART



2.2 COMMISSIONING PHASES

2.2.1 PRE-DESIGN PHASE

- Owner's Design Intent documentation developed and distributed.
    - WSP Group has produced a sustainable design intent for this project which highlights the sustainable and energy efficiency goals of the project.
- Design team members on the Commissioning Team identified
- Design team commissioning roles and responsibilities reviewed with team members
- Architectural, mechanical and electrical Basis of Design (Design Brief) reviewed.
    - The Basis of Design for this project is captured in the outline spec which has been updated as the project progressed.

2.2.2 DESIGN PHASE

- CxA provides early design review at approx 100% DD.
- Design Consultants respond to the design review in writing
- CxA provides pre-tender design review at 80% construction drawings and specifications.
- Design Consultant responds in writing.
- Further commissioning meetings held with design team members to discuss design requirements and review commissioning comments as necessary.
- Commissioning specification finalized for inclusion in tender package including:
    - Commissioning team roles and responsibilities
    - Communication protocol
    - Equipment and systems included in commissioning
    - Preliminary Installation verification checklists
    - O&M manual requirements
    - O&M training agenda

2.2.3 CONSTRUCTION PHASE

- CxA issues finalized Installation verification Checklists.
- Construction team members of the Commissioning Team identified
- Commissioning kick-off meeting held to explain construction phase commissioning process, roles and responsibilities with team members
- Shop drawings reviewed for conformance with energy efficiency requirements, maintenance needs and other issues in conjunction with the design engineers
- CxA provides periodic inspections of the systems to be commissioned in order to provide assistance with identification of potential installation issues of concern
- Periodic commissioning meetings held with trades to ensure commissioning requirements are understood, review deficiencies as necessary, coordinate equipment start-ups, pre-functional testing and functional performance testing. In particular, meetings will require attendance by:

- PM
- General Contractor
- Mechanical Contractor
- TAB (Balancing) Contractor
- Controls Contractor
- Electrical Contractor

- Contractors named above submit completed Installation Verification Checklists.
- TAB (Balancing) contractor issues a detailed pre-balancing inspection report.

2.2.4 ACCEPTANCE PHASE

- Contractor submits installation verification / start-up reports
- CxA reviews and spot-checks Installation Verification Checklists and start-up reports.
- TAB (Balancing) contractor submits a draft of the final balancing report.
- Functional performance Testing begins:
  - CxA spot checks balancing and modes of operation with TAB and controls contractors.
- Design consultant reviews, witnesses and signs-off on commissioning forms and check sheets before and after equipment being verified as an acceptance of compliance to design intent
- CxA reviews O&M manuals and as-builts to verify they are complete.
- CxA oversees owner training provided on the operation, adjustment, maintenance and safety requirements of commissioned systems.
- Some functional performance testing is seasonally dependant and deferred until weather conditions permit.
- CxA generates final commissioning report including all results from installation verification, start-up, functional testing, training, and reviews of the O&M manuals and as-built drawings for submittal to the Owner
- CxA generates re-commissioning manual for Owner's on-going verification of systems and continued acceptable operational performance

2.2.5 OPERATION PHASE

- Deferred testing performed as weather conditions and operational conditions in the facility allow.

Final review of any deficiencies or warranty items identified over the warranty period.

3 COMMISSIONING WORK PRODUCTS

3.1 DESIGN PHASE

The design intent is established by the Owner and the basis of design is provided by the consulting team. The commissioning requirements are developed and incorporated into the contract document

3.1.1 OWNERS PROJECT REQUIREMENTS (OPR) (BY OWNER, ARCHITECT)

The OPR is prepared or assembled by the Owner and Architect to properly reflect the Owner's intent and requirements for the services the building will deliver. The OPR documents the owner's requirements for the building and systems including HVAC, lighting, indoor environment, energy efficiency, siting, water and environmental responsiveness. This is a living document that will evolve as the project and design evolve.

3.1.2 BASIS OF DESIGN (BOD) (BY ARCHITECT, DESIGN ENGINEERS)

BOD (or Design Brief) is prepared in three parts by Architect, Mechanical Engineer and Electrical Engineer. The BOD documents the designers' proposals for meeting the requirements of the OPR, and includes information on items that influence design decisions such as occupancy, space and process requirements, codes and standards, load and climatic assumptions. This is a living document that will evolve as the project and design evolve. The CxA will review and verify that the basis of design and proposed systems and strategies meet the OPR, and will prepare a summary of issues that may require attention to ensure all OPR needs are appropriately addressed.

3.1.3 DESIGN REVIEWS (BY CXA)

Design reviews are prepared by the CxA at the 50% and 95% design stages. The reviews ensure the design meets the design intent and the basis of design is adhered to, and focus on the systems to be commissioned with respect to functionality, energy performance, maintainability, sustainability, system cost, indoor environmental quality, and environmental impact.

3.1.4 SPECIFICATIONS (BY ARCHITECT, DESIGN ENGINEERS)

Commissioning specifications are developed by the architect and design engineers with assistance from the CxA. Specifications outline the responsibilities of the contractors in the commissioning process. This includes requirements in meetings participation, submittals for review, installation verification, deficiency remediation, equipment start-up, TAB, and functional performance testing.

3.2 CONSTRUCTION PHASE

Periodic commissioning meetings are held with trades throughout the construction phase to ensure commissioning requirements are understood, review deficiencies as necessary, coordinate equipment start-ups, pre-functional testing and functional performance testing.

3.2.1 COMMISSIONING PLAN (BY CXA)

The commissioning plan (this document) is developed by the CxA and summarizes the tasks involved at each stage of the commissioning process. The document also outlines the responsibilities of each member of the commissioning Team. The Cx Plan is a living document and is updated as the project evolves.

3.2.2 CONTRACTOR SUBMITTAL REVIEWS (BY CXA)

The CxA reviews the controls submittals for commissionability and performance. The reviews ensure that sequences do not compromise the overall intent, will run as efficiently as possible, will adequately meet the Owner's requirements and environmental objectives.

3.2.3 INSTALLATION VERIFICATION CHECKLISTS (IVC) (BY CXA AND CONTRACTORS)

Installation (Pre-Functional) Checklists developed by the CxA and completed by the contractors with spot checks by the CxA and verification by the design consultant. IVC checklists review the quality of the installation including equipment condition, accessibility, serviceability, adherence to installation requirements, completeness, and operational preparedness. On major pieces of equipment, basic start-up parameters are also included such as voltage, motor amps, on/off control, and motor rotation direction. Pre-balancing inspection reports also constitute part of installation verification.

- CxA provides periodic inspections of the systems to be commissioned in order to provide assistance with identification of potential installation issues of concern
- Periodic commissioning meetings held with trades to ensure commissioning requirements are understood, review deficiencies as necessary, coordinate equipment start-ups, pre-functional testing and functional performance testing.
- Contractors submit completed Installation Verification Checklists.

3.2.4 EQUIPMENT START-UP AND BALANCING

Equipment start-up and testing dates are established and incorporated into the construction schedule. Start-up procedures, equipment start-up and balancing work are all witnessed by the commissioning authority as necessary.

- Contractor submits installation verification checklists and all manufacturer start-up reports
- TAB (Balancing) contractor submits a draft of the final balancing report.

3.2.5 FUNCTIONAL PERFORMANCE TESTING (FPT) (BY CXA AND CONTRACTORS)

FPT forms and procedures are developed by the CxA; and reviewed, verified and approveed by the Design Consultant. On-site testing is performed by the contractors under direction of the CxA. Performance testing is a collection of dynamic tests that evaluates the systems through all modes of operation. FPT verifies operation of the equipment, controls sequences and interconnected systems comply with the design intent. Some functional performance testing is seasonally dependant and deferred until weather conditions permit.

3.3 OCCUPANCY PHASE

3.3.1 O&M MANUALS (BY CONTRACTORS)

Contractors are responsible for compiling the O & M manuals for all equipment supplied. The CxA and the Design Consultant will review and comment on completeness and to ensure the information is specific to the equipment installed on-site. The main sections required include; preventative maintenance schedule, troubleshooting guide, spare parts list, contact information, shop drawings and warranty information.

3.3.2 O&M TRAINING (BY CONTRACTORS / MANUFACTURER'S REPS)

O&M training timetable is developed by the PM and contractor in conjunction with the CxA and delivered by the contractor or manufacturer's rep for each major piece of equipment or equipment type installed. The party

performing the training shall provide complete and relevant handouts to attendees. Topics covered in the training session should include:

- General description of the system and its operation including identification of major components
- Identification of operating controls and safeties including normal and abnormal sensor readings
- Review of the O&M manuals for identification of service requirements, procedures, wiring diagrams, parts identification, safety procedures, etc.
- Operational review for start-up, normal operation, shut down, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting and alarms
- Interactions with other systems and adjustments and optimizing methods for energy conservation
- Regular maintenance requirements including frequency, parts and equipment, and tools needed, replacement parts sources
- Identification of contacts for service support and maintenance parts

3.3.3 COMMISSIONING REPORT (BY CXA)

Prepared by the CxA, the commissioning report will be submitted to the owner soon after testing is complete. The commissioning report will contain the following:

- Final copies of OPR and BOD
- Copy of commissioning specifications
- Completed IVC and FPT checklists (Appendix)
- Value of commissioning process
- Outstanding commissioning issues
- Site reports history of deficiencies and corrective actions (Appendix)

3.3.4 SYSTEMS MANUAL (BY ALL PARTIES)

The systems manual is developed by the CxA and will contain the following information:

- Final version of the OPR and BOD documents.
- As-built sequences of operations for all equipment including initial schedules and set points.
- Ongoing instructions for maintaining proper operation.
- Functional performance test plan and a recommended schedule for ongoing testing.
- Seasonal operational guidelines.
- Recommendations for recalibration frequency of sensors and actuators.
- Troubleshooting table and guidelines for continuous maintenance of the owner's requirements.

3.3.5 OCCUPANT CONCERN PLAN (BY CXA)

The CxA will provide a plan for reporting of occupant concerns to the operating staff. The CxA will also work with the contractor to ensure that deficiencies are resolved before the end of the warranty period. At approximately two (2) months before warranty expiry, the CxA will review any outstanding deficiencies and occupant concerns with the Owner, occupants, their maintenance staff and contractor. The meeting will serve to finalize solutions to any outstanding issues that remain to be resolved. A final deficiency and action list will be developed. Suggestions for operational improvements will also be documented. A commitment will be obtained from the contractor as to the actions to be undertaken and the timeline for remediation of any and all warranty issues.

4 PROJECT TEAM MEMBERS AND RESPONSIBILITES

Commissioning team Contact Information specific for this project is located in Appendix A.Commissioning team members with roles and responsibilities for this project are listed below.

4.1 CLIENT/OWNER

- Define the owner's project requirements in the design intent, and provide a copy of the document to the commissioning team.
- Provide operating personnel to attend training and instruction regarding specific components, equipment and systems.
- Retain the services of independent third parties for system verification and certification as required in the document or by applicable codes.
- Observe on site installation, start up and testing of equipment and systems, during site walk-throughs and when possible.
- Review and approve commissioning documentation, including test results and reports.

4.2 CONSULTANT

- Define the basis of the design to meet the owner's requirements as detailed in the design intent.
- Review the contractors' submittals, such as, shop drawings to ensure compliance with the contract documents.
- Periodically observe the installation throughout the construction stages to determine that the installation generally conforms to the requirements of the contract documents and issue field observation reports.
- Review operating and maintenance manuals, balancing and test reports and as-builts for accuracy.
- Witness selected tests; note any deficiencies and provide field observation reports.
- Review commissioning progress reports and issues log, and address any items directed to the consultant(s).
- Review, witness and sign-off commissioning forms and check sheets before and after equipment being verified as an acceptance of compliance to design intent.

4.3 COMMISSIONING AUTHORITY (CXA)

- Participate in design team meetings. Obtain Owner's Design Intent and Consultant's Basis of Design, and system performance expectations. This will form the basis of the testing and commissioning documents.
- Review of the design and tender design documents and provide feedback to the commissioning team with emphasis on testing, commissioning, operation and maintenance of the proposed system and equipment.
- Provide commissioning documents, such as specifications and commissioning plan, to form part of the Bid documents.
- Review contractor's approved shop drawing submission for commissioning related issues.
- Develop commissioning schedule.
- Prepare the equipment test data forms.
- Monitor, check and inspect the installation throughout the construction stage.

- Supervise steps in the commissioning process including scheduling.
- Prepare and distribute commissioning issues log noting any issues that may have an impact on the commissioning of equipment and systems.
- Attend construction site meetings as required to discuss commissioning related items and any impact on Project schedule.
- Set-up and chair commissioning meetings.
- Witness and validate tests. note issues in issues log, and distribute commissioning progress reports.
- Complete system checks, system integration and failure mode testing with the Contractor.
- Work with the project team to expeditiously resolve any problems that may arise due to site conditions
- Coordinate training and instructions provided by manufacturers and suppliers. Recommendation of any additional training and/or instruction of operating and maintenance personnel deemed necessary over and above that already provided.
- Prepare Systems Operation Manual.
- Prepare and distribute the final commissioning report.

4.4 CONTRACTOR

- Manage and ensure entire installation comply with requirements of the Contract Documents.
- Submit shop drawings complete with Contractor's Stamp of Review.
- Submit working detail (interference or installation) drawings, as required
- Complete testing and commissioning forms provided by the CxA.
- Complete Owner's facilities management New Equipment forms, if applicable.
- Cubmit an installation schedule. This schedule shall include:
    - Time schedule of each activity, with lead and lag time allowed and indicated.
    - Shop drawings and working detail drawings submission.
    - Major equipment delivery and factory testing dates.
    - Coordinated installation activities and sequences in compliance with the general contractor's project schedule and other trade's installation schedule.
    - Schedule of testing and commissioning of the systems and major equipment.
- Submit a commissioning schedule. This schedule shall include:
    - Time schedule for system and equipment commissioning which are in compliance with the timing and sequences of installation schedule stated above. In this schedule allow for additional time for testing and commissioning, such that re-test of the equipment can be performed in a timely manner if required without impacting the overall project schedule or cause delay to project completion.
    - Dates for completion of required factory tests prior to equipment delivery to the site shall be indicated in the schedule.
- Prepare and submit prefunctional checklists for review and approval by the commissioning authority.
- Attend progress and commissioning meetings.
- Promptly rectify or replace reported deficiencies and defects.
- Where required by codes and/or specification, retain manufacturers and/or independent third parties to provide service for testing and certification of the systems and training of owner's personnel.
- Provide training and instruction to the Owner's operating personnel.

- Perform testing and commissioning of equipment and systems to the satisfaction of the Consultant and Commissioning Authority. Testing and commissioning will be witness by the Commissioning Authority as required. Contractor or his retain agents shall also record procedure and finding in reviewed test and record forms. Submit test and record forms with the signature of the tester for review by the Consultant and Commissioning Authority.
- Pay for and be responsible for all inspections required by codes, specification and Authorities having Jurisdiction. Obtain and submit all Certificate of Approval for such inspections and verifications.
- Submit for review as-builts drawings including those for location of control devices and wiring and operating and maintenance manuals for each equipment as per the specification requirements.
- Provide Operating and Maintenance Manuals for review by the Consultant and Commissioning Authority with all the testing and commissioning results and reports incorporated.
- Obtain, issue and assign warranties for equipment and systems to the Owner.
- Provision of all necessary test equipment shall be the responsibility of the contractor. Provide recently validated calibration certificate for all equipment to be used for verification prior to testing and commissioning commencement.
- Optimize operation according to occupant's needs, using the System Operation Manual prepared by the Commissioning Authority as reference points.
- Complete all commissioning procedures and activities and performance verification procedures which were delayed or not concluded during the commissioning phase.
- Complete system checks, once between the first and third month of building operation and once between the fourth and tenth month in a season opposite to the first or third month visit.
- Complete rectification of all deficiencies revealed by these checks. Equipment manufacturers involved in commissioning shall participate in systems checks.
- Revise all "as-built" and operating and maintenance documents to reflect all changes, modifications, revisions and adjustment upon completion of commissioning.
- Schedule a question and answer session for the operating and maintenance personnel 3 months after handover of the facility to the Owner. The duration of this session or sessions will be dictated by the number of questions or concerns that shall be addressed.

4.5 COMMUNICATIONS PROTOCOL

The following protocols will be used on this project. Requests for information or formal documentation by the CxA are handled through the normal communication channels. Minor issues may be handled through more informal discussions between the contractor, the designers or other parties directly involved and/or the CxA as appropriate.

ISSUE	PROTOCOL
Requests for information or formal documentation.	CxA goes first through the PM.
Minor or verbal information and clarifications	CxA goes direct to the informed party.
Notifying contractors of deficiencies	CxA documents deficiencies through the PM, but may discuss deficiency issues with contractors and Design Consultants prior to notifying the PM.
Scheduling functional tests or training	CxA provides input and schedule review of testing and training. Scheduling is done through the GC / PM.
Scheduling commissioning meetings	CxA requests the date and schedules through the GC / PM.

Request for significant changes	CxA has no authority to issue change orders.
Making minor changes to the installed sequences of operations	**Minor** changes in sequences of operations and graphical representations required to correct or enhance system operations may be requested by the CxA, but must be documented
Making significant changes to the installed sequences of operations	The CxA may recommend to the design engineer PM changes in sequences of operation to improve efficiency or control.
Subcontractors disagreeing with requests or interpretations by the CxA	Resolve issues at the lowest level possible. First with the CxA, then with the GC and PM. Some issues may require input from the A/E team.

The Primary Consultant/PM will ensure that the appropriate Design Consultants respond in writing to all documents issued by the CxA. The Primary Consultant/PM shall issue copies of the following documents to the CxA:

- Updated Construction drawings, specifications and addendums
- Contemplated Changes c/w all related sketches
- Change Orders c/w all related sketches
- Site instructions
- Field review reports
- Construction meeting minutes
- Request for information with response

4.6 MEETINGS

The Commissioning Authority attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in commissioning. The Construction Manager and the General Contractor provide the Commissioning Authority with information regarding substitutions, change orders, and any Engineer/ Architect supplemental instructions that may affect the commissioning of equipment, systems, or the commissioning schedule. The Commissioning Authority may review construction minutes, change orders, or site instructions for the same purpose.

Commissioning Meetings may also be scheduled during construction by the Commissioning Authority to include all of the commissioning team members. Those meetings shall address commissioning related responsibilities as well as the preparation for all specified testing, documentation, O&M manuals, training, and post-construction requirements.

4.7 PROGRESS REPORTING AND ISSUES LOG

The Commissioning Authority provides the Owner and project team with regular commissioning progress reports. These Issues Logs generally contain a list of new and outstanding deficiencies and a description of commissioning progress corresponding to the plan. The Commissioning Authority maintains a log of all commissioning related issues that require current or future attention. This record allows for clear tracking of the status of documentation and testing for each piece of equipment and each system. Information can include installer, party responsible for start-up, approval dates for check lists and test forms, their completion, training, O&M documentation review, etc.

5 SYSTEMS INCLUDED IN COMMISSIONING

The following is a list of systems to be commissioned, but not limited to the following. Refer to the project specifications for more details on the Commissioning requirements. Commissioning shall include all HVAC systems and associated controls, lighting controls, domestic hot water systems and renewable energy systems. Refer to Appendix A for a detailed list of systems to be commissioned.

5.1 SYSTEMS TO BE COMMISSIONED

5.1.1 FIRE PROTECTION EQUIPMENT

- New fire pump
- Pump variable speed drive controls
- New water tank/tower level controls

5.1.2 ELECTRICAL SYSTEMS

- Diesel generator and load bank
- Automatic transfer switch for emergency power

5.2 EXCLUDED SYSTEMS

Mechanical (HVAC systems), domestic hot and cold water systems, lighting and lighting controls, security, locks, audio/video, telephone, networking, elevators, process equipment and other specialty systems normally commissioned by the supplier / installer are not included in the scope of commissioning.

END OF DOCUMENT

APPENDIX A.

COMMISSIONING TEAM CONTACT INFORMATION

ROLE	NAME(S)	CONTACT INFORMATION
Owner	Jerry Aujla Jerry Quintel Jason Westcott	jerry.aujla@csc-scc.gc.ca jerry.quintel@csc-scc.gc.ca jason.wescott@csc-scc.gc.ca
PSPC Representative	Shawn Lumsden Marcel Banica Jeannine Nguyen	Shawn.Lumsden@pwgsc-tpsgc.gc.ca Marcel.Banica@pwgsc-tpsgc.gc.ca Jeannine.Nguyen@pwgsc-tpsgc.gc.ca
Commissioning Authority	Mihir Shah Boyd England Mike Edwards	Mihir.Shah@wsp.com Boyd.England@wsp.com Mike.C.Edwards@wsp.com
Architect	Sherri Tupin	Sherri@turpinkong.ca
Mechanical Engineer	Doug Cargill Steve Gundy	Doug.Cargill@wsp.com Steve.Gundy@wsp.com
Electrical Engineer	Keith Rogers Cyrus Mak	Keith.Rogers@wsp.com Cyrus.Mak@wsp.com
Construction Project Manager	TBD	
General Contractor	TBD	
Mechanical Contractor	TBD	
Electrical Contractor	TBD	

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

.2 Related Requirements

.1 Section 01 91 13 - General Commissioning Requirements

.2 Section 01 91 31 - Commissioning Plan

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Cx Authority, supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative and Cx Authority. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's, Cx Authority's and Consultant's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

.1 Cx Authority will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.

.2 Revise items on Commissioning forms to suit project requirements.

.3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Departmental Representative, Cx Authority, or Consultant; develop appropriate verification forms and submit to Departmental Representative, Cx Authority, or Consultant for approval prior to use.

.2 Additional commissioning forms to be in same format as provided by Cx Authority.

1.7 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Cx Authority provides Contractor project-specific Commissioning forms with Specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and signed off by General Contractor.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Provide Departmental Representative and Cx Authority with originals of completed forms.

.12 Maintain copy on site during start-up, testing and commissioning period.

.13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual.

1.8 LANGUAGE

.1 To suit the language profile of the awarded contract.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 This Section specifies roles and responsibilities of Commissioning Training.

.2 Related Requirements

.1 Section 01 91 13 - General Commissioning Requirements
.2 Section 01 91 31 - Commissioning Plan
.3 Section 01 91 33 - Commissioning Forms
.4 Section 01 79 00 - Demonstration and Training
.5 Section 25 01 12 - EMCS: Training

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Departmental Representative and Cx Authority will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shutdown of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 Management Manual.

.5 TAB and PV Reports.

.3 Project Manager, Cx Authority, and Facility Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:

.1 Transparencies for overhead projectors.

.2 Multimedia presentations.

.3 Manufacturer's training videos.

.4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be three (3) hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Departmental Representative, Cx Authority, and Consultant will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Review of facility and occupancy profile.

.2 Functional requirements.

.3 System philosophy, limitations of systems and emergency procedures.

.4 Review of system layout, equipment, components and controls.

.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Inter-Action among systems during integrated operation.

.10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.9 VIDEO-BASED TRAINING

.1 Manufacturer's videotapes to be used as training tool with review and written approval from Departmental Representative, Cx Authority, and Consultant one (1) months prior to commencement of scheduled training.

.2 On-Site training videos:

.1 Videotape training sessions for use during future training.

.2 To be performed after systems are fully commissioned.

.3 Organize into several short modules to permit incorporation of changes.

.3 Production methods to be professional quality.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit demolition drawings:

.1 Submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional engineer registered or licensed in the Province of Alberta Canada, showing proposed method.

1.3 SITE CONDITIONS

.1 Review "Designated Substance Report" and take precautions to protect environment.

.2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Proceed only after receipt of written instructions have been received from Departmental Representative.

.3 Notify Departmental Representative before disrupting building access or services.

Part 2 Products – Not Applicable

Part 3 Execution

3.1 EXAMINATION

.1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

.1 Protection of In-Place Conditions:

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.5 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Demolition/Removal:

.1 Remove items as indicated.

.2 Remove parts of existing building to permit new construction.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Refer to demolition drawings and specifications for items to be salvaged for reuse.

.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 OF SECTION

PART 1 - GENERAL

1.1 General And Related Work

.1 Read this Section in conjunction with all other Sections so as to comply with the requirements of the General Conditions of the Contract.

.2 The site conditions identify the locations and condition of all known asbestos-containing materials projected to be disturbed by the work of this contract. The specification fulfills the requirements of the report required by the Alberta *Occupational Health and Safety Regulation* (Alberta Queen's Printer, 2020), *Alberta Asbestos Abatement Manual* (Government of Alberta, 2019) hereafter referred to as 'The Regulations'; and, *Alberta User Guide for Waste Managers*, available online from Alberta Environment and Parks.

.3 Unless otherwise shown or specified it is the intent that Work performed as per this Section will result in the removal and disposal or decontamination of all asbestos-containing materials (ACMs) and all materials, which have been contaminated by ACMs.

1.2 Site Conditions

.1 The report entitled *"Asbestos and Lead Testing, Drumheller Institution, Drumheller, Alberta"* conducted by WSP Canada Inc., dated June 6, 2018 forms part of the Site Conditions of this Section of the Specification.

.2 Notify Owner Representative of suspect asbestos-containing materials discovered during Work that were not apparent from drawings, specifications, or reports pertaining to Work. Do not disturb such material until instructed by Owner Representative.

1.3 Outline of Work

.1 Requirements and procedures for asbestos abatement of the following ACMs:

.1 Removing ACM cement paste present on flanged connections, around valves, and pipe elbows in the fire pump room and at flanged connections in the tank room at the proposed work area.

.2 Removing non-ACM joint tape compound and fiberglass insulation around the cement paste.

1.4 Action and Information Submittals

.1 Submit an Asbestos Project Notification Form to Occupational Health and Safety within 72 hours of the work including set-up operations.

.2 Submit proof satisfactory to Owner Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

.3 Submit proof of Contractor's Asbestos Liability Insurance.

.4 Submit Workers Compensation Board status and transcription of insurance.

.5 Submit to Owner Representative procedures to deal with emergencies such as fire or injuries.

.6 Submit to Owner Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.

.7 Submit proof satisfactory to Owner Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.8 Submit proof of asbestos abatement course attendance, of not less than two days duration.

.9 Submit proof satisfactory to Owner Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

.10 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS's) for required chemicals or materials.

1.5 Personal Protection

.1 Instruct personnel in use of respirators, use of Glove Bags, and all aspects of work procedures and protective measures.

.1 A competent person as defined by the Occupational Health and Safety Act must provide instruction.

.2 Supply negative pressure non-powered half-face respirators, with high efficiency (P100) cartridge filters, certified by the National Institute of Occupational Safety and Health (NIOSH) or other testing agency acceptable to the Ministry of Labour.

.1 Personnel must wear respirators at all times during Glove Bag installation, use, or removal and during final cleaning of piping.

.2 Maintain respiratory equipment in proper functioning and clean condition.

.3 Filters used shall be replaced or tested according to the manufacturers specifications and replaced as necessary.

.4 Ensure that no person required to use Glove Bag has facial hair, which affects the seal between respirator and face.

.3 Provide personnel with full body coveralls including attached head covering. Once coveralls are worn they must be treated and disposed of as asbestos contaminated waste.

.1 Personnel must wear coverall during installation, use, or removal of Glove Bag and during final cleaning of piping.

.4 Utilize hard hats, safety shoes and other protective apparel.

.5 Workers shall not eat, drink or smoke in Asbestos Work Area.

.6 Ensure workers are fully protected as specified above at all times when possibility of disturbance of ACM exists.

1.6 Authorized Visitor Protection

.1 Provide clean protective clothing and equipment and approved respirators to Authorized Visitors.

.2 Ensure Authorized Visitors have received required training for entry into Asbestos Work Area.

1.7 Air Monitoring

.1 Air monitoring may be performed using Phase Contrast Microscopy (PCM) following the National Institute for

Occupational Safety and Health method 7400.

.2 Co-operate with the Asbestos Abatement Consultant in collection of air samples, including providing workers to wear sampling pumps at least once per shift. Contractor's forces must exercise care with Asbestos Abatement Consultant's equipment.

.3 Results of PCM samples that show airborne fibre levels above background levels, outside Asbestos Work Area, will indicate asbestos contamination of these areas. The contaminated areas shall be isolated and cleaned in the same manner applicable to the Asbestos Work Area, at no cost to the Owner. The area will be considered contaminated until visually inspected and air-monitoring results are show airborne fibre concentrations at or below background levels.

.4 PCM samples may be collected from within the Asbestos Work Area, after the site has passed a visual inspection and an acceptable coat of lock-down agent has been applied to all surfaces of piping from which ACM has been removed. These airborne fibre levels must be less than 0.01 fibre/cc. If these results show fibre levels in excess of 0.01 fibre/cc, Contractor shall re-clean the entire Asbestos Work Area and apply another acceptable coat of lock-down agent to all surfaces. These actions will be repeated until fibre levels are less than 0.01 fibre/cc.

1.8 Inspection

.1 From commencement of work until completion of clean-up operations, the Asbestos Abatement Consultant will be present periodically on site.

.2 Inspection of the Asbestos Work Area will be performed to confirm compliance with the requirements of the specification and governing authorities. Any deviations from these requirements that have not been approved in writing may result in a stoppage of work, at no cost to the Owner.

.3 The Asbestos Abatement Consultant is empowered by the Owner to inspect adherence to specified procedures and materials, and to inspect for final cleanliness and completion. Additional labour or materials expended by Contractor to provide performance to the level specified shall be at no additional cost.

.4 The Asbestos Abatement Consultant is empowered by the Owner to order a shutdown of work when a leakage of ACM from the controlled work area has occurred or is likely to occur. Additional labour or materials to rectify unsatisfactory conditions shall be at

no cost to the Owner.

.5 Materials and equipment must meet approval of the Asbestos Abatement Consultants. Unacceptable materials shall be replaced at no cost to the owner.

PART 2 - PRODUCTS

2. Materials and Equipment

.1 Asbestos Waste Container: An impermeable container acceptable to disposal site, and identifying its contents, hazards and necessary precautions for handling the waste materials. Comprised of one of the following:

.1 A sealed Glove Bag, inside a 6 mil (0.15 mm) sealed polyethylene bag.

.2 A sealed Glove Bag, inside a rigid sealed container of sufficient strength to prevent perforation of the container during filling, transportation and disposal.

.2 Glove Bag: Manufactured Glove-Bag in configurations suitable for work. If bag is to be removed from a pipe for use on a new section of pipe, bag must have a closure strip.

.3 HEPA Vacuum: Vacuum with necessary fittings, tools and attachments. Discharged air must pass through a HEPA filter.

.4 Knife: Knife with fully retractable blade for use inside Glove Bag.

.5 Lock-down Agent: Sealant for purpose of trapping residual dust. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry. Lock-down agent shall be compatible with replacement insulation or fireproofing where required and capable of withstanding service temperature of substrate.

.6 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.

.7 Protective Coveralls: Disposable full body coveralls complete with hoods, manufactured of a material, which

does not permit penetration of asbestos fibres.

.8 Rip-Proof Polyethylene Sheeting: Minimum requirements: 8 mil (0.20 mm) fabric made up from 5 mil (0.13 mm) weave and 2 layers of 1.5 mil (0.05 mm) poly laminate. In sheet size to minimize on-site seams and overlaps.

.9 Securing Straps: For Glove Bag, reusable nylon straps at least 1" wide with metal tightening buckle for sealing ends of bags around pipe and/or insulation.

.10 Sprayer: Garden reservoir type, low velocity, capable of producing mist or fine spray.

.11 Tape: Fibre reinforced duct tape suitable for temporary repair of damaged insulations.

.12 Wetting Agent: Non-sudsing surface-active agent. Acceptable product Aqua-Gro or approved equal.

PART 3 - EXECUTION

3.1 Preparation

.1 Isolate Asbestos Work Area with tape barriers, saw-horses or other barriers.

.1 Signs are to be displayed in all areas where access to Asbestos Work Area is possible. Such signs shall read:

CAUTION
Asbestos Dust Hazard
Avoid Breathing Dust
Wear Protective Equipment

Breathing Asbestos Dust May Cause Cancer
Entry is Prohibited Except to Authorized Persons

Eating, Drinking and Smoking are Prohibited in this Area

3.2 Pipe Insulation Removal

.1 Prior to use of Glove Bag on damaged or unjacketed insulation:

.1 Place polyethylene drop sheet beneath the area in which the glovebag is to be installed.

.2 Spray any areas of damaged insulation jacketing with mist of amended water.

.3 Tape over damaged insulation to provide temporary repair.

.4 Mist areas of insulation with no jacketing and wrap with polyethylene sheeting.

.5 Clean surface using HEPA vacuuming or damp wiping where minor amounts of fallen or damaged insulation.

.2 Place any tools necessary to remove insulation in tool pouch built into Glove Bag. Insert nozzle of spray pump into bag through valve and seal the opening. Insert nozzle of vacuum cleaner fitted with HEPA filter into the bag and seal the hole.

.3 Install Glove Bag as per manufacturers instructions.

.4 Seal valve cover with wire tie or equivalent on valve Glove Bags.

.5 Remove insulation from pipe as per manufacturer's directions.

.6 Volume and weight of insulation must not exceed capacity of bag or supports.

.7 Arrange insulation in bag to maximize use of bag.

.8 Remove metal jacketing or banding carefully to minimize the possibility of ripping or puncturing bag.

.9 Insert nozzle of spray pump into bag through valve and clean pipe and interior of upper section of bag thoroughly. Use one hand to aid washing process. Wet surface of insulation in lower section of bag and any exposed end of asbestos insulation remaining on pipe by spraying with water. Apply sealant to the inside upper section of the bag prior to removal of the bag.

.10 If bag is to be removed from a pipe for use on a new section of pipe, perform the following:

.1 Wash top section of Glove Bag thoroughly. Place all tools in the lower pouch of the glove bag (below the closure strip).

.2 Insert nozzle of HEPA filtered vacuum cleaner into bag through valve and evacuate air from bag.

.3 Seal closure strip. Remove bag from pipe and seal in new location before reopening closure strip.

.11 Loosen holding straps and carefully move bag and re-seal to pipe using double-pull zipper to pass hangers if bag is to be moved along the same pipe. Repeat insulation removal operation.

.12 Cease work and repair opening if, during use, the Glove Bag is ripped, cut or opened in any way. Utilize hood on disposable coverall if bag becomes cut or opened in any way.

.13 Clean up and remove with a HEPA vacuum all spilled material.

.14 To remove bag after completion of insulation removal operation:

.1 Wash top section of Glove Bag and tools thoroughly. Place all tools in one hand (glove), pull hand out inverted, twist to create a separate pouch, tape inverted hand at two separate locations 2.5 cm apart so as to seal pouch. Remove inverted hand and tools by cutting between the two tape seals.

.2 Place inverted hand pouch and tools into the next clean Glove Bag to be used or into a water bucket, open pouch underwater and clean tools and then allow drying.

.3 Insert nozzle of HEPA filtered vacuum cleaner into bag through valve and evacuate air from bag. Keep vacuum operational during removal of glove bag from pipe.

.4 Remove nozzle of vacuum and tape over end of valve.

.5 Pull a 6-mil polyethylene bag over glove bag before removing from pipe. Remove securing straps. Unfasten zipper. Seal Glove Bag and seal 6-mil polyethylene bag so as to create asbestos waste container. Dispose of as asbestos waste.

.15 Ensure pipe is clean of all residues after removal of Glove Bag. If necessary, after removal of each section of asbestos, vacuum all surfaces of pipe, using HEPA vacuum or wipe with wet cloth.

.16 Seal all surfaces of freshly exposed pipe with Lock-down Agent. Cover exposed ends of any remaining asbestos insulation with lagging cloth or tape.

.17 Remove drop sheets and dispose of as asbestos waste.

3.3 Waste and Material Handling

.1 Ensure ACM or asbestos-contaminated materials removed during work are treated, packaged, transported and disposed of as asbestos waste.

.2 Transport asbestos contaminated waste to a licensed landfill.

END OF SECTION

PART 1 GENERAL

Read this section in conjunction with all other sections so as to comply with the requirements of the General Conditions of the Contract.

Where there is conflict of information and/or requirements specified between the specification, reports and drawings, the most stringent shall apply.

1.1 SECTION

.1 Comply with requirements of this Section when disturbing and/or removing lead containing paints and materials. The following activities are low-risk activities:

.2 Comply with requirements of this Section when disturbing and/or removing lead containing paints and materials providing that operations are limited to:

- .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap, if required.
- .2 Removal of lead-containing coatings or materials using a power tool with an effective dust collection system equipped with a HEPA filter, if required.
- .3 Removal of lead-containing coatings or materials with non-powered hand tool, other than manual scraping and sanding, if required.
- .4 Installing or removing sheet metal that contains lead.
- .5 Transporting sealed containers of lead waste.
- .6 Work operations that generate an airborne lead concentration of less the eight-hour exposure limit of 0.05mg/m^3.

1.2 REFERENCES

.1 Government of Alberta.

- .1 Alberta Queen's Printer (2020). *Occupational Health and Safety Regulation.*
- .2 *Occupational Health and Safety Code.* Part 4 Chemical Hazards, Biological Hazards and Harmful Substances - Section 41 Lead exposure control plan.
- .3 Environmental Protection and Enhancement Act (Alberta)

.2 Government of Alberta.

- .1 Occupational Health and Safety Bulletin, Lead At The Work Site (2013). Employment and Immigration.

.3 Government of Canada. 2016.

- .1 Canadian Consumer Product Safety Act, Surface Coatings Materials Regulations (Lead), SOR/2016-193.

.4 Department of Justice Canada

- .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Environmental Contaminants Act (Canada)

.5 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).

.6 Transport Canada

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.2 Dangerous Goods Transportation and Handling Act (Alberta) and Regulations

.7 Asbestos and Lead Testing, Drumheller Institution, Drumheller conducted by WSP Canada Inc., dated June 7, 2018.

1.3 DEFINITIONS

.1 HEPA Vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Owner's Representative or designated representatives.

.3 Polyethylene: Polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.

.4 Sprayer: Garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.5 Exposure Limit: Employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic meter of air (50 ug/m^3) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic meter of air for removal of lead-based paint by methods noted in paragraph 1.1.

.6 Competent Person: Owner's Representative capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with applicable Sections.

.2 Provide proof satisfactory to Owner’s Representative that suitable arrangements have been made to dispose of lead-based paint waste in accordance with requirements of authority having jurisdiction.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:

.1 Provide Owner's Representative necessary permits for transportation and disposal of lead-based paint waste and proof that lead-based paint waste has been received and properly disposed.

.2 Provide proof satisfactory to Owner's Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Do construction occupational health and safety with applicable Sections.

.2 Safety Requirements: worker and visitor protection.

.1 Worker Protection:

.1 Protective equipment and clothing to be worn by workers in accordance with the level of risk of the activity.

.1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.

.2 Half mask respirator: half-mask particulate respirator with P-series filter, and 100% efficiency could be provided.

.2 Eating, drinking, chewing, and smoking are not permitted in work area.

.3 Ensure workers wash hands and face when leaving work area.

.4 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead-contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in Work Area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work Area or from Equipment and Access Room.

.5 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not to use this system as means to leave or enter work area.

.6 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.7 Ensure workers wash hands and face when leaving Work Area.

.8 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.9 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.

.2 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to Work Areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.6 EXISTING CONDITIONS

.1 Information pertaining to lead-containing/based paint to be handled, removed, or otherwise disturbed and disposed of during this project, including the report entitled "***Error! No text of specified style in document.***, *Marshal Yard, Plan 9612511, Block 6, Lot 3, Medicine Hat, Alberta", is bound into this specification.* The aforementioned report is listed in Appendix A of the Specifications. This report is for general information only and it is not necessarily representative of all the lead and metal-containing materials covered within the scope of this Project.

.2 Notify Owner Representative of lead-based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Owner Representative.

1.7 SCHEDULING

.1 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.2 Notify Landfill authorized to accept hazardous wastes including lead-based and metal-based paints as per appropriate provincial and municipal environmental regulations.

.3 Provide Owner's Representative copy of notifications prior to start of Work.

.4 Ensure all necessary permits for lead work, variance, demolition, etc. are posted at the site prior to start of work.

.5 Submit to Owner Representative or a Third Party Consultant copy of notifications prior to start of Work.

.6 Hours of Work: perform work involving abatement as per agreement with Owner Representative or a Third Party Consultant.

1.8 OWNER'S INSTRUCTIONS

.1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.

.2 Instruction and training related to respirators includes, at minimum:

.1 Proper fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

.2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.3 Waste Containers: fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

PART 3 EXECUTION

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead containing paints.

3.2 PREPARATION

.1 Remove and store items to be salvaged or reused.

.1 Protect and wrap items and transport and store in area specified by Owner Representative or a Third Party Consultant.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Washing facilities must be provided, including wash basins, warm water, soap, and disposable towels.

.3 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.

.4 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.

.5 Seal off openings with polyethylene sheeting and seal with tape.

.6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.

.7 Protect floor surfaces covered from wall to wall with polyethylene sheets.

.8 Where water application is required for wetting lead-containing materials, provide temporary water supply appropriately sized for application of water as required.

.9 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.

.3 Do not start work until:

.1 Arrangements have been made for disposal of waste.

.2 Tools, equipment, and materials waste containers are on-site.

.3 Arrangements have been made for building security.

.4 Notifications have been completed and preparatory steps have been taken.

3.3 ABATEMENT

1. For painted surfaces in non-dispersible form (i.e. surfaces have no flaking paints):

.1 Sprinkle debris with water to prevent dust. Do not cause flooding, contaminated runoff or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.2 Remove lead-containing paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Segregate lead painted components from the demolition debris.

.4 Transport lead paint waste to landfill in a manner preventing lead paint dust from becoming airborne. Each load shall be accompanied by a properly completed manifest satisfactory to the authority having jurisdiction.

.5 Dispose of lead paint waste at a Class II landfill. No Toxicity Characteristic Leaching Procedure (TCLP) is required for painted surfaces in good condition. Pre-schedule the waste disposal with the landfill to ensure materials are handled appropriately.

.6 Contractor shall not allow lead-containing components to be recycled or ground up.

2. For painted surfaces in dispersible form (i.e. flaking):

.1 Before the work begins a HEPA filtered vacuum, and a pail of soap and warm water with disposable wiping rags (to use as a wash-up station), 0.15 mm polyethylene drop sheet, and good quality duct tape are required.

.2 Surfaces must be scraped using non-powered hand tools, to remove all flaking areas leaving only firmly adhered paint surfaces.

.3 When possible, remove flaking paint in one piece and place them on the polyethylene drop sheet.

.4 Fully seal the first drop sheet containing lead contaminated materials with duct tape. Wrap entire sealed pieces in a second layer of 0.150 mm polyethylene and seal all edges with duct tape.

.5 Spray the scraped surface areas with an industry recognized adhesive product to trap invisible fine dusts that may contain lead and could become airborne during demolition.

.6 Deliver a representative sample of the scraped paint flakes to a recognized laboratory for a Toxicity Characteristic Leaching Procedure (TCLP) test. Provide copy of test results to the Third Party Consultant.

.7 Repeat for in two operations, a HEPA vacuum or a wet clean, using Trisodium Phosphate (TSP) and warm water solution to all dust surfaces resulting from flaking lead paint removal.

.8 Remove disposable coveralls and gloves when leaving work area. Disposable coveralls and gloves shall be placed into polyethylene sheeting, wrapped and sealed air tight with duct tape, and disposed of as lead waste.

.9 Prior to removal of respirator, workers wash head, face and exterior of respirator thoroughly in wash up station, prior to removing the respirator.

.10 Dispose of all lead painted materials and other waste resulting from this work according to the results of the Toxicity Characteristic Leaching Procedure (TCLP). If the laboratory result is higher than 5.0 mg/L, the flaking lead paint waste shall be disposed of at a Class I landfill (Ryley or Drayton Valley are Class 1 landfills). If laboratory result is 5.0 mg/L or lower the lead waste shall be disposed of at Class II landfill.

.11 Transport lead paint waste to landfill in a manner preventing lead paint dust from becoming airborne.

.12 Each load shall be accompanied by a properly completed manifest satisfactory to the authority having jurisdiction. Pre-schedule the waste disposal with the landfill to ensure materials are handled appropriately.

.13 The contractor is not allowed to recycle or grind-up lead-containing components.

.14 After removing all the flaking paints, the remaining good condition lead containing surfaces can be demolished.

.15 A final visual inspection by Third Party Consultant is required at the end of the flaking lead paint removal to ensure the area is clean of building debris. The Third Party Consultant may collect surface lead samples and perform lead air tests to ensure the area is free of lead-containing dust.

.3 For painted surfaces in good condition and the substrate will be reused as part of a renovation project or maintenance activities:

.1 The paint stripping work shall include removal by a qualified lead paint removal contractor, together with air monitoring and inspection by Third Party Consultant.

.2 The procedures could involve: work area containment, negative air pressure, and electric heat gun or chemical stripping removal of the paint containing lead (no abrasive methods permitted).

3.4 REMOVAL PROCEDURE FOR BULK LEAD MATERIALS

.1 Handle, store, transport and dispose bulk lead materials in accordance with Alberta and Federal legislation and regulations.

3.5 TRANSPORTATION AND PERMANENT DISPOSAL

.1 Transport waste in accordance with provincial and federal legislation and regulations.

.2 Ensure all materials are properly packaged and labeled prior to transportation.

.3 Transport hazardous waste materials in properly placarded vehicles equipped with a rain and windproof box.

.4 Each load shall be accompanied by a properly completed Transportation of Dangerous Goods Regulation (TDGR) Waste Manifest. Provide the Third Party Consult Consultant with a copy of each shipping and waste manifest.

3.6 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Owner Representative or a Third Party Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Concrete Reinforcing Section 03 20 00
.2 Cast-in-Place Concrete Section 03 30 00

1.2 REFERENCE STANDARDS

.1 CAN/CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3-04 (R2010) - Design of Concrete Structures.

.3 CAN/CSA-S269.3-M92 (R2008) - Concrete Formwork.

Part 2 Products

2.1 FORMWORK MATERIALS

.1 Formwork materials shall conform to CAN/CSA-A23.1 and be:

.1 Form plywood is to be exterior grade. Plywood is to be resin coated one side (in contact with concrete), and is to be free from defects, damage, residual concrete, etc.

.2 Exposed surface formwork is to be square edged, smooth panels of plywood, metal or plastic. The panels are to be square and made in a true plane, clean, free from holes, surface marking and defects.

.3 Tubular forms: Spirally wound, adhesive laminated fibre paper tube forms with diameters as required, with a minimum bursting pressure of 965 kN/m² (140 psi) and internally treated with release agent.

2.2 ACCESSORIES

.1 Form Release Agent: Proprietary, non-volatile material which will not stain the concrete or impair the application of finishes or coating to the surface.

.2 Form Ties: Removable or snap-off metal ties, fixed or adjustable length, that act as both spreader and tie, and that may be broken back not less than 9 mm (3/8") from the concrete surface, free of devices leaving holes larger than 25 mm (1") diameter in concrete surface.

.1 For exposed concrete, use snap ties complete with plastic cone-shaped plugs and fillers of light grey concrete plugs, with a minimum diameter of 15 mm (5/8") and a minimum depth of 25 mm (1").

.3 Form Accessories: Inserts, ties or hangers, shall be commercially manufactured. Size and type as indicated on drawings.

.4 Chamfer Strips and Void formers: Wood or plastic type.

2.3 DESIGN

.1 Contractor shall be responsible for the design of formwork and its construction including shoring and bracing to ensure stability for the anticipated construction, gravity, equipment, worker and lateral loads related to the rate of concrete placing.

.2 Construct forms of wood, metal or other approved materials, to produce concrete conforming to the shape, lines and dimensions shown on the drawings and to prevent excessive mortar leakage.

.3 For multiple use applications, maintain formwork in such condition that the original dimensions and standard of finish produced does not deteriorate.

Part 3 Execution

3.1 INSTALLATION OF FORMWORK

.1 Erect and brace formwork plumb and true. Align form joints and make watertight. Keep form joints to a minimum.

.2 Coordinate with all other trades locations for chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.3 Coordinate with all other trades placing of anchors, sleeves and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.4 Tolerances:

.1 Variations from plumb: 6 mm (1/4") in 3.0 m (10'-0"), 9 mm (3/8") for longer dimensions.

.2 Variations in level: 6 mm (1/4") in 3.0 m (10'-0").

.3 Variations of the linear building lines and related position of columns, walls and partitions from plan: 6 mm (1/4") in 6.0 m (20'-0"), 12 mm (1/2") for longer dimensions.

.4 Variation in size of openings: ±12 mm (1/2").

.5 Variation in cross-sectional dimension: 3 mm (1/8") to 6 mm (1/4").

.6 Variation in steps: rise ±3 mm (1/8"), tread ±6 mm (1/4").

.5 Construct templates and supports as required to rigidly fix reinforcing dowels and anchor bolts in the forms prior to placing concrete.

3.2 PREPARATION OF FORMWORK SURFACES

.1 Untreated forms shall be kept moist prior to the placing of concrete and wetted at the time of placing, in order to prevent concrete shrinkage.

.2 Treated formwork shall have the approved form coating applied in accordance with the manufacturer's recommendations before reinforcement and cast-in items are placed. Remove any excess form coating.

.3 Thoroughly clean and retreat forms before reusing.

3.3 REMOVAL OF FORMWORK

.1 Do not remove forms, shores and bracing until the concrete has gained sufficient strength to carry its own weight and construction and design loads which are liable to be imposed on it. The strength of concrete is to be verified by compressive test results.

.2 Remove falsework progressively so that no shock loads or unbalanced loads are imposed on the structure. In general, unless otherwise approved, load supporting forms may be removed when the concrete has attained 70% of the required design twenty-eight (28) day compressive strength if the construction is re-shored.

.3 Forms not directly supporting the weight of concrete may be removed as soon as the stripping operation will not damage concrete.

.4 The removal of form ties shall be done carefully to avoid marking the concrete and to allow for patching. Grout the bottom of form tie holes to prevent rust staining in exposed areas.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Concrete Forming and Accessories — Section 03 10 00

.2 Cast-in-Place Concrete — Section 03 30 00

1.2 REFERENCE STANDARDS

.1 CAN/CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3-04 (R2010) - Design of Concrete Structures.

.3 CAN/CSA-G30.18-09 – Carbon Steel Bars for Concrete Reinforcement.

.4 CAN/CSA-W186-M1990 (R2012) - Welding of Reinforcing Bars in Reinforced Concrete Construction.

.5 American Concrete Institute (ACI) Detailing Manual 2004-(SP-66).

.6 Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice, 28th Edition.

1.3 SUBMITTALS

.1 Prepare and submit shop drawings, consisting of bending, cutting and placing drawings for all reinforcing steel.

.1 Generally, placing to be in accordance with the ACI Manual of Standard Practice for Detailing Reinforcing Concrete Structures and the CRSI Manual of Standard Practice for Placing of Reinforcing Bars.

.2 Structural drawings take precedence over placement drawings and bar schedules.

1.4 INSPECTION

.1 The Departmental Representative's general review are undertaken to inform the Departmental Representative of the Contractor's performance, and in no way, shall augment the Contractor's quality control procedures or relieve him of his contractual responsibilities.

.2 Advise the Departmental Representative a minimum of twenty-four (24) hours prior to placement of concrete. Failure to give adequate notice may cause the Departmental Representative to classify the work as defective.

.3 Concrete shall not be placed until the reinforcement and its placement has been reviewed by the Departmental Representative.

.4 Correct defects and irregularities to the satisfaction of the Departmental Representative, at no cost to the Departmental Representative.

1.5 DELIVERY, STORAGE AND CLEANING

.1 Reinforcing steel, welded wire fabric, and accessories shall be delivered, handled and stored as required to prevent contamination and damage.

.2 All steel reinforcement, before being placed, shall be cleaned of loose scaly rust, dirt, oil, paint and other coatings that may be detrimental.

Part 2 Products

2.1 MATERIALS

.1 Reinforcing bars: billet steel deformed bars, Grade 400R 400MPa (60 ksi) yield strength, conforming to CAN/CSA-G30.18-M92 (R2007).

.2 Weldable reinforcing bars: weldable low alloy steel deformed bars, Grade 400W 400MPa (60 ksi) yield strength, conforming to CAN/CSA-G30.18-M92 (R2007).

.3 Welded steel wire fabric: sizes and gauges are to be as shown on the structural drawings, flat sheets only.

.4 Supports: wire chairs, bolsters, hanger bars, spirals, stirrups and plastic spacers of size and strength to adequately support reinforcing in required position.

.5 Tie wire: annealed wire, 1.5 mm (16 ga) or heavier.

2.2 FABRICATION

.1 Fabricate reinforcing to CAN/CSA-A23.1/A23.2-04.

.2 Reinforcing bars shall be cold bent. Reinforcing bars shall not be straightened or re-bent without written approval of the Departmental Representative.

.3 The location of reinforcement splices not shown on the drawings shall be approved by the Departmental Representative and shall, for beams and slabs, be away from points of maximum stress in the steel.

2.3 DETAILING

.1 Conform to CAN/CSA-A23.1-04 and CAN/CSA-A23.3-04 for all hooks, bends, laps and similar details not specifically noted.

.2 Lap bottom bars at support locations and top bars at mid-spans, unless noted otherwise on drawings.

.3 Provide 610 mm (24") long (each leg) corner bars to match all horizontal bars at all wall and grade beam corners and intersections.

.4 Provide 4 extra 15M diagonal corner bars around holes larger than 100 mm (4") in floor slabs and walls. Corner bars shall be 1.5 times length of shortest side of hole or minimum 750 mm (30") long.

.5 Provide 15M bar each face for holes larger than 1000 mm (40") in walls.

.6 Cover electrical conduit, ductwork or piping buried in slabs with 600 mm (24") wide strip of 152 x 152 x MW13.3 x MW13.3 (6x6x8/8) welded wire fabric. If principal slab reinforcement is placed above conduit then place 600 mm (24") strip under conduit. Position of reinforcing steel takes precedence over conduit, ductwork or piping.

Part 3 Execution

3.1 PLACING

.1 Place reinforcement within a tolerance of 6 mm (1/4") for slab steel and 12 mm (1/2") for other steel. Locate bends and end of bars within 50 mm (2") of specified location.

.2 Provide minimum concrete cover to reinforcing steel in accordance with CAN/CSA-A23.1-04 and as indicated herein or on drawings:

.1 Cast against and permanently exposed to earth 76 mm (3").
.2 Interior faces 40 mm (1 1/2").

.3 Where a structural concrete member is required to have a fire resistance rating, provide minimum concrete cover to reinforcing steel in accordance with Appendix D of the Alberta Building Code, except where indicated otherwise on drawings.

.4 Provide 10M "U" spacers at 3 m (10'-0") on centre horizontally and 1.5 m (5'-0") on centre vertically to hold wall reinforcing mats in position.

.5 Provide non-corrosive and non-staining reinforcing steel supports at surfaces where concrete will be exposed.

.6 Set all wall and column dowels prior to placing concrete so that each dowel is maintained in its correct position. Do not insert dowels in freshly placed concrete unless approved by the Departmental Representative.

3.2 WELDING

.1 Any welding of reinforcing steel shall be in accordance with CAN/CSA-W186-M1990 (R2007).

.2 No welding of reinforcing steel shall occur without approval of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1	Concrete Forming and Accessories	Section 03 10 00
.2	Reinforcing Steel	Section 03 20 00
.3	Concrete Finishing	Section 03 35 00

1.2 REFERENCE STANDARDS

.1 CAN/CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3-04 (R2010) - Design of Concrete Structures.

.3 CAN/CSA-A3000-08 (Consolidation) - Cementitious Materials Compendium.

.4 ASTM D1751-04 (2008) - Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).

.5 CAN/CGSB-51.33-M89 - Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

1.3 TESTING

.1 Testing of concrete and concrete materials will be carried out by testing agency employed by the Contractor and approved by the Departmental Representative. Provide access for such testing.

.2 It is the Contractor's responsibility to call for the specified number of tests at the appropriate time. Provide and maintain facilities for the temporary storage of concrete test cylinders.

.3 Any additional testing, or retesting, required as a result of materials not meeting the specifications is to be paid for by the Contractor.

.4 Perform a complete test set for each 50 cubic meters (65 cubic yards) of concrete, or fraction thereof, and in any event, not less than one (1) test set for each type of concrete each day it is used.

.5 Each test set, conforming to CAN/CSA-A23.2, is to consist of:

.1 Slump test;
.2 Air content test;
.3 Temperature measurement and
.4 Not less than three (3) moulded specimens for compression testing. Test one (1) at seven (7) days and two (2) at twenty-eight (28) days.

.6 Provide the Departmental Representative with copies of all concrete test results at regular intervals. Reports are to include the following:

.1 Project name;
.2 Date of sampling;
.3 Air temperature at time of sampling;
.4 Concrete temperature;
.5 Concrete supplier;
.6 Exact location on the structure at which the concrete test set is taken;
.7 Slump;
.8 Air content;
.9 Method of curing;
.10 Cylinder strength.

.7 When air temperature is below 0°C (32°F) during placement, or is likely to fall below 0°C (32°F) within twenty-four (24) hours after placement, make two (2) additional specimens for compression testing. Field cure those two (2) cylinders in a manner which simulates as closely as possible the curing of the placed concrete.

Part 2 Products

2.1 CONCRETE MATERIALS

.1 Portland Cement: conforming to CAN/CSA-A3000-03 (Consolidation), type as per Concrete Mix Schedule.

.2 Water: conforming to CAN/CSA-A23.1.

.3 Aggregates: conforming to CAN/CSA-A23.1, containing no shale, sizes as per Concrete Mix Schedule.

.4 Air Entraining Admixture: conforming to CAN/CSA-A23.1, percentage as per Concrete Mix Schedule.

.5 Chemical Admixtures: the Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 ACCESSORY MATERIALS

.1 Concrete Bonding Agent: Approved proprietary material to be applied directly to concrete or mixed with cement and sand before application.

.2 Concrete Curing Agent: conforming to CAN/CSA-A23.1.

.3 Polyethylene Vapour Barrier: 150 micrometre (6mil) polyethylene film, Type 1, conforming to CAN/CGSB-51.33.

.4 PVC Waterstops: extruded polyvinylchloride with ribbed flanges, 150 mm (6") x 5 m (16'-0") unless noted otherwise.

.5 Edge Joint Filler: Bituminous impregnated fibreboard, 12 mm (1/2") thick, conforming to ASTM D1751.

.6 Grout: Non-shrink, non-metallic dry pack or flowable, 35MPa (5 ksi) compressive strength at twenty-eight (28) days.

.7 Control Joint Sealant: Cold-applied rubberized-asphalt sealer, 'W.R. Meadows' #158, or equivalent.

2.3 MIX DESIGN

.1 Use ready-mix concrete conforming to CAN/CSA-A23.1 and these specifications. Site-mix concrete is permitted for placements not exceeding 1 cubic metre (1.5 cubic yards) and for core-filling masonry and bond beams.

.2 Concrete shall be Normal Weight with a unit weight of 23.6 kN/m³ (150 pcf).

.3 No Calcium Chloride, in any form, is permitted in any concrete mix without the written approval of the Engineer.

.4 Cement: Concrete Type and Strength for concrete in contact with soil are to be confirmed with Geotechnical Engineer.

.1 Type HS: High Sulphate.

.2 Type GU: General Use.

.5 Curing: Concrete Placing and Curing shall not be carried out in temperatures lower than 5°C (40°F) without protective measures.

.6 The variation of minimum twenty-eight (28) day compressive strength shall be within 15%.

.7 Tolerance in slump shall be 20 mm (3/4") for specified slumps less than 75 mm (3"), and 30 mm (1-1/8") for slumps of 75 mm (3") and greater.

2.4 CONCRETE MIX SCHEDULE

Component	Min. Comp. Strength	Type	Maximum Aggregate Size	Water/ Cement Ratio	Slump	Air Content	Curing Type	Exposure Class
Ext. Slab on Grade (Sidewalk & Apron)	32 MPa	HS	20 mm	0.45	70 mm	4-7%	2	C-2
Footings	*30 MPa	HS	20 mm	0.50	80 mm	4-7%	1	F-1
Foundation Walls	*30 MPa	HS	20 mm	0.50	80 mm	4-7%	1	F-1
Slab on Grade	25 MPa	GU	20 mm	0.55	70 mm	None	1	N

* Strength at 56 days, otherwise at 28 days.

Part 3 Execution

3.1 EXAMINATION AND PREPARATION

.1 No flooding water is permitted on foundation beds and skim coats where footings and other concrete work is to be placed. Place concrete only on frost-free ground. Remove previously frozen bearing surfaces.

.2 Ensure that foundations bear on undisturbed soil. If bearing surfaces are rejected because conditions do not meet those anticipated during the design, make adjustments only as directed. No extra payment will be made for adjustments made necessary because of damage to bearing surfaces caused by weather, traffic or removal of frozen material.

.3 Ensure that compacted fill has been placed to meet specified requirements, and that underground services have been installed, inspected, tested and approved.

.4 Keep excavations dry while placing concrete.

.5 Before concrete is placed, all reinforcing steel, accessories and hangers, inserts, conduits, sleeves, outlets, etc. must be securely tied in place and reviewed.

.6 All dirt, clips, sawdust, water, snow, ice and other foreign matter must be removed from forms and reinforcing steel.

.7 When experience or weather records indicate adverse temperatures are probable, plan for protecting all concrete at early ages is to be established and the necessary special equipment and materials are available on-site before adverse temperatures occur.

3.2 CONDUITS, PIPES, OPENINGS AND INSERTS

.1 Electrical conduit and other pipes embedded in the concrete are not to be of a material harmful to the concrete and are to be:

.1 Not be a larger outside diameter than one-third (1/3) the thickness of the slab in which they are embedded;

.2 Not be spaced closer than 3 diameters on centre unless otherwise shown on the Drawings;

.3 Have a concrete covering of not less than 25 mm (1").

.4 Be so installed that it will not require cutting, bending or displacement of the reinforcement or impair the structural strength of the system.

.2 Provide and cast in all sleeves, frame-outs, inserts, and fastening devices, including reglets and nailing strips, unless otherwise specified.

.3 Anchor bolts, nuts and washers for structural steel and precast concrete shall be supplied and installed by the Contractor. Anchor bolts shall be set before concrete placement in accordance with approved shop drawings. Other anchoring devices for structural steel shall be supplied by the steel trades and installed by the Contractor in accordance with approved shop drawings.

.4 The Contractor shall cooperate will all trades who are placing inserts, bolts, sleeves, hangers, conduits, reglets, nailers, etc.. Contractor shall notify other trades sufficiently in advance to ensure that provision is made for openings, inserts and fastenings.

.5 Costs for cutting, coring and inserts in concrete for installation of sleeves, inserts, bolts, conduits, etc. not installed prior to concrete placement shall be at the cost of the Trade requiring the sleeves, inserts, bolts, conduits, etc..

.6 Contractor shall grout all openings or sleeves in the concrete after the completion of work by other Trades.

3.3 PLACING CONCRETE

.1 Place concrete in conformance with the requirements of CAN/CSA-A23.1.

.2 The time lapse between the introduction of cement into the concrete mixes and final placement of the concrete into the forms shall not exceed one hundred twenty (120) minutes (two (2) hours).

.3 Conveying and placing equipment is to be such that when concreting has started, the depositing of concrete will be at such a rate and of such sequence that the concrete is at all times sufficiently plastic to ensure proper bonding of successive layers or panels.

.4 Equipment and tools are to be kept free from hardened concrete and foreign material and is to be cleaned at frequent intervals.

.5 Concrete is to be placed in the forms as close as it is practical to its final position to avoid segregation due to re-handling or flowing.

.6 To prevent segregation, the vertical height of free fall of concrete is not to exceed 1.5 m (5'-0"). For falls of greater than 1.5 m (5'-0"), or if segregation occurs, chutes and spouts designed to prevent segregation of concrete are to be used.

.7 While concrete is being placed it is to be consolidated thoroughly and uniformly by means of tamping, hand tools, vibrators or finishing machines to secure a dense, homogeneous structure, close bond with reinforcement and with smooth formed surfaces. Internal vibrators are to be used whenever practical.

.8 Internal vibrators are to be applied at the point of deposit in the areas of freshly placed concrete, allowed to sink by their own weight in the concrete until they penetrate into the previous layer of concrete. They are to be withdrawn immediately at the same speed at which they sank, moved about 300 mm (12") to a new location and the process repeated. Extreme care is to be taken to ensure that internal type vibrators do not disturb the reinforcing steel or the forms.

.9 Place concrete as a continuous operation stopping only at construction joints indicated on the drawings or as follows: At centre of span of suspended slabs, beams and joists; in walls and columns immediately above or below floor construction; at centre of steel beam that supports concrete slab. The Departmental Representative must approve all construction joint locations and may, at his discretion, require keys, mortises or extra reinforcing to be provided by the Contractor at construction joints not shown on the drawings.

3.4 SLAB CONSTRUCTION

.1 The tops of all floor slabs, including slabs on grade, are to be brought to an even, level or sloping surface as indicated of the Drawings and steel trowel finished to a tolerance of 12 mm (1/2") in 3.0 m (10'-0") dimension and ±12 mm (1/2") overall.

.2 Maintain topping slab thickness as indicated on Drawings. Thickness of topping are not be modified to facilitate finishing to specified tolerances, or to compensate for cambers in supporting structural members.

3.5 COLD WEATHER PROTECTION REQUIREMENTS

.1 Cold weather protection requirements shall be as per CAN/CSA-A23.1, except that the following minimum requirements must also be met:

.1 Protection Against Early Frost Damage: Effective means is to be provided for maintaining the temperature of the concrete in place above 10°C (50°F) for a minimum period of three (3) days or until sufficient hydration has occurred to protect the concrete from frost damage.

.2 Protection for Structural Safety: If, subsequent to the above period of protection, the ambient conditions are not likely to be favourable for continuous strength development, the protection period is to be extended until the concrete has achieved sufficient strength for structural safety.

.3 Protection for Strength and Durability: When subsequent ambient conditions are not conductive to continue during and strength development, the protection period is to be extended until a total period of seven (7) days at temperatures above 10°C (50°F) has been attained.

.4 Concrete Temperature: When the air temperature is at or below 5°C (40°F) or when there is a probability of its falling to that limit within twenty-four (24) hours of placing, the temperature of the concrete as placed is to be between 10°C (50°F) and 30°C (85°F).

.5 Placing: Concrete is not to be placed against any surface that is at a temperature of less than 5°C (40°F) or will lower the temperature of the concrete once placed to below 10°C (50°F).

.6 Cold Weather Protection: Protection is to be provided for newly placed concrete by means of suitable enclosures, coverings and/or adequate insulation as follows:

.1 For temperatures from 0°C (32°F) to 5°C (40°F), suitable covering plus adequate insulation.

.2 For temperatures below 0°C (32°F), suitable enclosure plus supplementary heat or adequate insulation.

.7 Heating of Enclosures: At the time of placing and during placing, concrete surfaces are to be protected by formwork or an impermeable membrane from direct exposure to the combustion gasses of heaters.

.8 Protection by Insulation: The amount of insulation required to properly cure concrete in cold weather is to be determined on the basis of the expected air temperatures and wind velocity (wind chill), the size and shape of the concrete structure and the amount of cement in the mix.

.9 Cooling After Protection: To avoid cracking of the concrete due to sudden temperature change near the end of the curing period, the protection is not to be completely removed until the concrete has cooled to the temperature differential of 15°C (60°F).

3.6 HOT WEATHER PROTECTION REQUIREMENTS

.1 Hot weather protection requirements shall be as per CAN/CSA-A23.1, except that the following minimum requirements must also be met:

.1 Job Preparation: Facilities are to be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. In extremely hot weather, the formwork, reinforcement and concreting equipment is to be protected from the direct rays of the sun, or cooled by fogging or evaporation.

.2 Concrete Temperature: When the air temperature is at or above 25°C (75°F) or when there is a probability of it rising to this temperature during the placing, special effort is to be made to maintain the temperature of the concrete as low as practical, and in no case more than 30°C (85°F).

.3 Protection From Drying: When the rate of surface moisture evaporation exceeds 0.75 kg/m²/hr, concrete shall be protected according to one or more of the following measures:

.1 dampening the subgrade prior to placing the concrete;
.2 erecting sunshades over the concrete during finishing operations;
.3 lowering the concrete temperature;
.4 covering the concrete surface with white polyethylene sheeting between the various finishing operations;
.5 beginning the concrete curing immediately after trowelling; or
.6 placing and finishing at night.

3.7 CURING

.1 Curing of concrete shall be as per CAN/CSA-A23.1, except that the following minimum requirements must also be met:

.1 All equipment needed for curing and protection of the concrete is to be on hand and ready for use before actual placing is started.

.2 The water used for curing is to be clean and free from any materials that will stain or discolour the concrete.

.3 A liquid, membrane forming curing compound may be used under circumstances where application of such compounds will not jeopardize the appearance of the concrete or the bonding of floor finishes.

.4 Wheeling, handling, piling or storing of any material over or on slabs is prohibited during the first seven (7) days after placing concrete.

.5 Initial Curing: Keep concrete surface continuously moist for minimum twenty-four (24) hours after placement.

.6 Final Curing:

.1 Type 1 (Basic): Immediately following Initial Curing and before the concrete has dried; all exposed, non-formed surfaces are to be cured for a period of at least three (3) consecutive days, at which time the temperature of the air in contact with the concrete is to be above 10°C (50°F) or for a time necessary to attain 40% of the specified strength.

.2 Type 2 (Additional): Immediately following Initial Curing and before the concrete has dried; all exposed, non-formed surfaces are to be cured for a period of at least seven (7) consecutive days, at which time the temperature of the air in contact with the concrete is to be above 10°C (50°F) or for a time necessary to attain 70% of the specified strength.

.3 Type 3 (Extended): Immediately following Initial Curing and before the concrete has dried; all exposed, non-formed surfaces are to be wet cured for a period of at least seven (7) consecutive days. The Acceptable Wet Curing Methods Are:

.1 Ponding or continuous sprinkling.
.2 Absorptive mat or fabric kept continuously wet.
.3 Continuous steam vapour mist bath not exceeding 65°C (150°F).
.4 Polyethylene sheet covering, min. 300 mm (12") lapped and edges weighted.

3.8 ACCEPTANCE

.1 Where material or workmanship fails to meet the requirements of the specifications and tests, the work may be rejected by the Departmental Representative. Rejected work shall be replaced or repaired to the Departmental Representative's approval.

END OF SECTION

Part 1 General

1.01 REFERENCES

.1 American Concrete Institute (ACI):

.1 ACI 117-10, ACI Manual of Practice: Specifications for Tolerances for Concrete Construction and Materials, and Commentary.

.2 ACI 301-10, Specification for Structural Concrete.

.3 ACI 302.1R-04, ACI Manual of Practice: Guide for Floor and Slab Construction.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

.2 ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20-95, Surface Sealer for Floors.

.4 Canadian Standards Association (CSA)

.1 CSA-A23.1- 09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete, Includes Updates through No. 1 (2011).

.5 International Concrete Repair Institute (ICRI)

.1 ICRI 03732P-1997, Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.

.6 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-04, Architectural Coatings.

1.02 PERFORMANCE REQUIREMENTS

.1 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

1.03 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittals.

.1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.

.2 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.

.3 Include application instructions for concrete floor treatments.

.2 Submit closeout data in accordance with Section 01 33 00 – Submittals.

.1 Provide manufacturer’s printed recommendations for general maintenance, including cleaning instructions and submit a complete list of floor care products that will be required for on-going maintenance.

1.04 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

1.05 ENVIRONMENTAL REQUIREMENTS

.1 Temporary lighting:

.1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq. m of floor being treated.

.2 Electrical power:

.1 Provide sufficient electrical power to operate equipment normally used during construction.

.3 Work area:

.1 Make the work area water tight protected against rain and detrimental weather conditions.

.4 Temperature:

.1 Maintain ambient temperature of not less than 10 degrees C from seven (7) days before installation to at least forty-eight (48) hours after completion of work and maintain relative humidity not higher than 40% during same period.

.5 Moisture:

.1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

.6 Safety:

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Arrange for ventilation system to be operated during installation of concrete floor treatment materials by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces.

.3 Provide continuous ventilation during and after coating application.

Part 2 Products

2.01 PERFORMANCE/DESIGN CRITERIA

.1 F1-Finishing: Floors having a straightedge value of ±8 mm over 3050 mm with overall F-number of F_F 20 x F_L 15; floors having an SWI of 4 mm; similar to CSA A23.1 Class A Slab Finishing.

.2 F3-Finishing: Floors having a straightedge value of ±5 mm over 3050 mm with overall F-number of F_F 30 x F_L 25; meeting requirements for CSA A23.1 Class C slab finishing.

2.02 LEVELLING MATERIALS

.1 Underlayment: Cementitious, self-levelling, single component, polymer modified underlayment and manufacturer's low VOC recommended primer, for application thicknesses to a minimum feather edge to 13 mm; acceptable materials as follows:

.1 Sikafloor Level 125, Sika Canada Ltd.
.2 Sure-Flo ST, Gemite.
.3 Ultraplan Easy, MAPEI Canada Inc.
.4 Approved equal

2.03 HARDENERS

.1 Type: 1, Sodium silicate, permanent penetrating sealer and hardener

.1 Liquid applied, water based, chemically reactive.

.2 Non-toxic, non-flammable, and anti-dusting have low or no VOC.

.3 Colour: colourless.

.4 Acceptable Materials:

.1 Ashford Formula, Curecrete

.2 Seal Hard, L&M Construction Company

.3 Sealtight Liqui-Hard, W.R. Meadows

.4 Sikafloor 3S, Sika Canada

.2 Water: potable.

2.04 SEALING COMPOUNDS

.1 Surface sealer: to CAN/CGSB-25.20, Type 2 - water based, clear.

.1 Surface sealers manufactured or formulated with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, hexavelant chromium and their compounds are not acceptable.

.2 Surface sealer shall be compatible with the hardener and shall be manufactured by hardener manufacturer.

.3 Surface sealer shall have less than 100g/l of VOC in accordance with SCAQMD Rule #1113.

.2 Wax: acrylic carnuba wax.

2.05 CURING COMPOUNDS

.1 Select low VOC, water-based, organic-solvent free curing compounds.

.1 Concrete Curing Compounds: maximum VOC limit 100 g/L in accordance with SCAQMD Rule #1113.

2.06 MIXES

.1 Mixing, ratios and application in accordance with manufacturer's instructions.

2.07 ACCESSORIES

.1 Joint Filler Strips:

.1 Floor Isolation Joints: ASTM D1751, bituminous impregnated fibreboard, or ASTM D1752, cork or self-expanding cork, 13 mm thick minimum.

.2 Edge Joint Filler: ASTM D1751, bituminous impregnated fibreboard, 13 mm thick minimum.

.2 Control Joint Filler:

.1 Two (2) component, epoxy-urethane, load bearing, self-levelling sealant.

.1 Acceptable Material:

.1 Loadflex, Sika Canada.

Part 3 Execution

3.01 EXAMINATION

.1 Prepare floor surface in accordance with CSA A23.1.

.2 Verify that slab surfaces are ready to receive work and elevations are as instructed by manufacturer.

3.02 REPAIRS

.1 Inspect surfaces for defects immediately after removal of forms. Repair or patch defects within forty-eight (48) hours of removal of forms with cure repairs same as new concrete with the Departmental Representative's permission.

.2 Defective Areas: where patches are allowed, repair and patch areas to match surrounding areas in texture and colour.

3.03 PREPARATION OF SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

.2 Saw cut control joints to CSA-A23.1, twenty-four (24) hours maximum after placing of concrete.

.3 The tops of all floor slabs, including slabs on grade, are to be brought to an even, level or sloping surface as indicated on the drawings, ready to receive the specified finish.

.4 The minimum floor flatness as indicated as indicated below.

.5 Interior floors indicated as exposed concrete are to be finished in accordance with the slab finishing schedule on the structural drawings. For slab areas not noted in the finishing schedule, slabs shall be smooth concrete with steel trowel finish.

.6 Depress floor slabs where shown and as required for floor finishes.

.7 Remove any curing agents used during concrete installation a minimum of twenty-eight (28) days prior to installation of flooring materials.

.8 Use mechanical stripping to remove chlorinated rubber or existing surface coatings.

.9 Use protective clothing, eye protection, and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.04 FINISHING FORMED SURFACES

.1 Requirements listed below apply to normal structural concrete; refer to Structural Drawings cast-in-place concrete for additional requirements for formed exposed architectural concrete.

.2 Unspecified Finish: Provide following finishes as applicable when finish of formed surfaces is not specifically indicated:

.1 Unexposed Surfaces:

.1 Rough form finish for concrete not exposed to view.

.2 Smooth form finish for concrete to receive membrane waterproofing.

.2 Exposed Surfaces:

.1 Smooth form finish for concrete surfaces exposed to view.

.3 Rough Form Finish: Leave surfaces with texture imparted by forms; patch tie holes and defects; remove fins longer than 6 mm high.

.4 Smooth Form Finish: Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces with number of seams kept to a minimum, uniformly spaced in an orderly pattern; patch tie holes and defects; completely remove fins.

.5 Related Unformed Finish: Strike-off concrete smooth and finish with using texture matching adjacent formed surfaces at tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces; continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces.

3.05 FINISHING FLOORS AND SLABS

.1 Finish floors and slabs in accordance with CSA A23.1 and ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces; do not wet concrete surfaces.

.1 Floor finish FL-1 where indicated on finish schedule: 1/8in. deep cut, liquid densified, polished, liquid sealer followed by high speed burnish

.2 Unspecified: Provide following finishing classes as applicable when finishing requirements for floors is not specifically indicated:

.1 Exterior Slabs: F1-Finishing Class with a broom finish.

.2 Interior Slabs: F3-Finishing Class with a trowelled finish.

.3 Float (Initial) Finishing:

.1 Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power driven floats.

.2 Re-straighten, cut down high spots, and fill low spots.

.3 Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

.4 Apply float finishing to surfaces indicated and receiving trowel finishing.

.4 Trowel (Final) Finishing:

.1 Commence trowel finishing after all bleed water has disappeared and when the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface.

.2 Apply first trowelling and consolidate concrete by hand or power-driven trowel after applying float finishing; continue trowelling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance; repair or smooth any surface defects that would telegraph through applied coatings or floor covering.

.3 Apply a trowel finishing to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

.4 Finish surfaces to the tolerances indicated above.

.5 Broom Finishing:

.1 Apply a broom finishing to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

.2 Slightly roughen trafficked surface by brooming with fibre bristle broom perpendicular to main traffic route immediately after float finishing.

.3 Coordinate required final finishing with the 'Departmental Representative' before application.

3.06 APPLICATION: GENERAL

.1 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.

.2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.3 Clean overspray. Clean sealant from adjacent surfaces.

.4 Cure concrete in accordance with manufacturers recommended procedures.

3.07 APPLICATION: LIQUID APPLIED FLOOR HARDENER

.1 Apply liquid floor hardener in accordance with manufacturer's written instructions after initial floating.

.2 Cure concrete in accordance with manufacturer's recommended instructions.

3.08 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A 653/A 653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 CSA International

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
.2 CSA O121-08, Douglas Fir Plywood.
.3 CSA O141-05(R2009), Softwood Lumber.
.4 CSA O151-09, Canadian Softwood Plywood.
.5 CSA O153-M1980 (R2003), Poplar Plywood.
.6 CSA O325-07, Construction Sheathing.
.7 CAN/CSA-Z809-08, Sustainable Forest Management.

.3 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.6 Sustainable Forestry Initiative (SFI)

.1 SFI-2010-2014 Standard.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

.4 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling.

Part 2 Products

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 CAN/CSA-Z809 or FSC or SFI certified.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 Board sizes: "standard" or better grade.

.2 Dimension sizes: "standard" light framing or better grade.

.3 Post and timbers sizes: "standard" or better grade.

2.2 ACCESSORIES

.1 Nails, spikes and staples: to CSA B111.

.2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

2.3 FINISHES

.1 Galvanizing: to ASTM A 123/A 123M or ASTM A 653/A 653M, use galvanized fasteners for exterior work.

2.4 WOOD PRESERVATIVE

.1 Maximum allowable VOC limit 350 g/L.

.2 Surface-applied wood preservative: coloured, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

.3 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.4 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

Part 3 Execution

3.1 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum three (3) minute soak on lumber and one (1) minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material:

.1 Wood furring on outside surface of exterior masonry and concrete walls.
.2 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.2 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

.7 Install sleepers as indicated.

.8 Use caution when working with particle board. Use dust collectors and high-quality respirator masks.

3.3 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

3.4 SCHEDULES

.1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 50 00 - Temporary Utilities & Controls.

.4 Section 01 74 23 - Final Cleaning.

.5 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 Canadian Urethane Foam Contractors' Association Inc. (CUFCA).

.2 Green Seal Environmental Standards

.1 Standard GC-03-93, Anti-Corrosive Paints.

.2 Standard GS-11-97, Architectural Paints.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S101-04, Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC-S705.1-01, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.

.4 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two (2) copies WHMIS MSDS - Material Safety Data Sheets.

.3 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within three (3) days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Applicators to conform to CUFCA Quality Assurance Program.

.2 Qualifications:

.1 Installer: person specializing in sprayed insulation installations.

.2 Manufacturer: company with minimum five (5) years experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.

.3 Health and Safety Requirements: worker protection:

.1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations.

.2 Workers must wear gloves, respirators, long sleeved clothing, and eye protection when applying foam insulation.

.3 Workers must not eat, drink or smoke while applying foam insulation.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.6 SITE CONDITIONS

.1 Ventilate area in accordance with Section 01 50 00 - Temporary Utilities & Controls.

.2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and twenty-four (24) hour after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

.4 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

Part 2 Products

2.1 MATERIALS

.1 Insulation: spray polyurethane to CAN/ULC-S705.1.

.2 Primers: in accordance with manufacturer's recommendations for surface conditions.

.1 Maximum VOC limit 100 g/l.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 APPLICATION

.1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2.

.2 Use primer where recommended by manufacturer.

.3 Apply sprayed foam insulation to fill gaps in wall penetrations.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 23 - Final Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 SCHEDULE

.1 Apply spray foam in gaps in the exterior wall envelope that are created by the Work of the Contract. Refer to Section 07 92 00 - Joint Sealants for concealment of the foam.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 74 23 – Final Cleaning.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115-1995, Fire Tests of Fire Stop Systems.

1.3 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit digital copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: person specializing in fire stopping installations.

.2 Prior to beginning work of this Section:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Service penetration assemblies: systems tested to CAN-ULC-S115.

.2 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.3 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.4 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.5 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.6 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.7 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 23 – Final Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

.1 Fire stop and smoke seal at: service penetrations through fire-resistance rated concrete walls.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C 919-08, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.
.2 Primers.
.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Samples:

.1 Submit two (2) samples of each type of material and colour.

.2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.

1.5 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.

.2 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Silicones one part: to CAN/CGSB-19.13.

.2 Acrylic latex one part: to CAN/CGSB-19.17.

.3 Acoustical sealant: to ASTM C 919.

.4 Butyl: to CGSB 19-GP-14M.

.5 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene, urethane, neoprene or vinyl foam:

.1 Extruded closed cell foam backer rod.
.2 Size: oversize 30 to 50 %.

.2 Neoprene or butyl rubber:

.1 Round solid rod, Shore A hardness 70.

.3 High density foam:

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/mü density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond breaker tape:

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

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 joint sealants installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of back-up materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACK-UP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant:

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 INTENT

.1 This Section specifies requirements for site painting of mechanical and electrical work only.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate work specified in this Section with work specified in Section 23 05 43 to ensure correct colour selections.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheets in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Ensure emptied containers are sealed and stored safely.

.2 Unused paint coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

.3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

Part 2 Products

2.1 PAINT

.1 Refer to finish systems schedules at the end of this Section for product descriptions and product numbers. Product numbers are from the MPI Approved Product Lists.

.2 Use products suitable for anticipated surface temperatures of substrates while in service.

.3 Paint Materials:

.1 Refer to Schedule Sections for required finishing systems.

.2 Use only MPI approved products from the MPI Approved Product Lists corresponding to the specified finishing systems.

.3 Where the MPI Approved Products List identifies products for a given product type meet GPS-01-08 or GPS-02-08, designated by E1, E2 or E3, select products as follows:

.1 Use a product with either an E2 or E3 designation, where available.

.2 Where a product with an E2 or E3 designation is not available, use a product with a E1 designation.

.4 Thinners: Odorless paint thinner, pure and clean with no deleterious material.

Part 3 Execution

3.1 PREPARATION OF SUBSTRATES

.1 Clean and sand between coats using minimum #150 grit sand paper.

3.2 SUBSTRATES

.1 Painting is required on substrates specified below, at locations and by methods indicated in "Painting Schedule" in this Section.

.2 Mechanical Piping: Includes insulated and non-insulated pipe surfaces, pipe hangers, hanger rods and supports, valves, fittings and related components, located either on building interior or exterior surfaces.

.3 Electrical Conduit and Cable: Includes interior and exterior conduit and cable where exposed to sight.

3.3 LOCATIONS

.1 Painting is required at locations specified below, on substrates and by methods indicated in "Painting Schedule" in this Section.

3.4 METHODS

.1 Painting by methods specified below, are required on substrates and at locations indicated in "Painting Schedule" in this Section.

.2 Method 'P1' - Full Colour for Mechanical Piping and Equipment:

.1 Primary Colour Coding: Paint substrates in their entirety in required primary colour for mechanical equipment. Use applicable three (3) coat finish system.

.3 Method 'P2' - Full Painting in Uncoded Colours:

.1 Paint substrates in their entirety. Use applicable three (3) coat finish system.

.2 Except as otherwise specified below, colours shall be the same as wall or ceiling background colours.

.4 Method 'P3' - No Painting:

.1 Painting mechanical equipment and piping <u>not</u> required.

3.5 PAINTING MISCELLANEOUS ITEMS

.1 Paint inside of ducts at grilles and diffusers back approximately 600 mm so that duct interior is not visible when grilles and diffusers are installed. Apply one (1) coat Cementitious Primer and one (1) coat Alkyd Enamel, flat, black colour, before grilles and diffusers are installed.

.2 Paint concrete machine and equipment bases in coded colours and with 100 mm wide diagonal stripes as detailed in Infrastructure Colour Coding Requirements. Do not paint spring isolators.

.3 Do not paint sprinkler heads.

.4 Back-prime and paint surfaces and edges of plywood backboards for electrical and telephone equipment with one (1) coat Alkyd Wood Primer, white colour, and two (2) coats Alkyd Porch and Floor Enamel, grey colour, applied before backboards are installed.

3.6 MECHANICAL AND ELECTRICAL WORK PAINTING SCHEDULE

	Substrates					
Locations	**Mech. Piping**	**Mech. Equipment**	**Mech. Ductwork**	**Elect. Conduit and Cable**	**Other Work**	**Elect.**
Exposed in service areas	P1	P1	n/a	P3	P2	
Exposed in unfinished areas	P3	n/a	n/a	P3	P3	
Exposed in finished areas	P2	n/a	P2	P2	P2	
Semi-concealed spaces	P3	n/a	P3	P3	P3	
Permanently concealed spaces	P3	n/a	P3	P3	P3	
Exposed to exterior	P1	P2 P3	P2	P2	P2 P3	

Key: P1 - Full Painting in Coded Colours for Mechanical Piping and Equipment.
P2 - Full Painting in Un-coded Colours.
P3 - No Painting in Coded or Un-coded Colours.

Refer to articles 3.2, 3.3 and 3.4 of this Section for detailed descriptions of substrates, locations and methods.

3.7 FINISH SYSTEMS SCHEDULE FOR MECHANICAL AND ELECTRICAL WORK

Substrate	Finish System And Description		MPI Product No.
Iron and Steel Piping and Equipment	EXT 5.1D Alkyd, Gloss Level G6 - Gloss		
	1st Coat:	Alkyd Anti-Corrosive Metal Primer	79
	2nd Coat:	Alkyd	9
	3rd Coat:	Alkyd	9
Galvanized Metal Piping, Ductwork, Conduit, and Equipment	EXT 5.3B Alkyd, Gloss Level G6 - Gloss		
	1st Coat:	Cementitious Primer	26
	2nd Coat:	Alkyd	9
	3rd Coat:	Alkyd	9
Aluminum Jacketed Piping, Conduit, and Equipment (Exposed aluminum)	EXT 5.4A Alkyd, Gloss Level G6 - Gloss		
	1st Coat:	Vinyl Wash Primer	80
	2nd Coat:	Quick Dry Primer	9
	3rd Coat:	Alkyd	9
	4th Coat	Alkyd	
Copper Piping	EXT 5.5A Alkyd, Gloss Level G6 - Gloss		
	1st Coat:	Vinyl Wash Primer	80

Substrate	Finish System And Description		MPI Product No.
	2nd Coat:	Alkyd	9
	3rd Coat:	Alkyd	9
Canvas and Cotton Insulated Piping, Ductwork, and Equipment	INT 10.2B Modified, Alkyd, Gloss Level G5 - Semi-gloss		
	1st Coat:	Latex Primer Sealer and Latex Block Filler, 50/50 mix, white	50 & 4
	2nd Coat:	Alkyd	47
	3rd Coat:	Alkyd	47
Concrete Machine Bases and Curbs	INT 3.1D Alkyd, Gloss Level G5 - Semi-gloss		
	1st Coat:	Latex Primer Sealer	50
	2nd Coat:	Alkyd	47
	3rd Coat:	Alkyd	47
Iron and Steel Piping and Equipment	INT 5.1E Alkyd Finish, Gloss Level 5 - Semi-gloss		
	1st Coat:	Alkyd Metal Primer	79
	2nd Coat:	Alkyd	47
	3rd Coat:	Alkyd	47
Galvanized Metal Piping, Ductwork, Conduit, and Equipment	INT 5.3C Alkyd, Gloss Level G5 - Semi-gloss		
	1st Coat:	Cementitious Primer	26
	2nd Coat:	Alkyd	47
	3rd Coat:	Alkyd	47
High Heat Steel, Boilers, Breeching, Furnace Fronts, Piping, Flues, Heat Exchangers, etc.	INT 5.2B Heat Resistant Enamel, Aluminum, Maximum 800°F (427°C)		
	See note	Heat Resistant Aluminum	2
	Note - No. of coats and application procedures in accordance with manufacturer's recommendations		
	INT 5.2D High Heat Resistant Coating, Maximum 1100°F (593°C)		
	See note	High Heat Resistant Coating	22
	Note - No. of coats and application procedures in accordance with manufacturer's recommendations		
Aluminum Jacketed Piping, Conduit, and Equipment	INT 5.4A Alkyd, Gloss Level G5 - Semi-gloss		
	1st Coat:	Vinyl Wash Primer	80
	2nd Coat:	Alkyd	47
	3rd Coat:	Alkyd	47
Copper Piping	INT 5.5A Alkyd, Gloss Level G5 - Semi-gloss		
	1st Coat:	Vinyl Wash Primer	80
	2nd Coat:	Alkyd	47
	3rd Coat:	Alkyd	47

Substrate	Finish System And Description		MPI Product No.
Plastic Piping	INT 6.8B Alkyd, Gloss Level G5 - Semi-gloss		
	1st Coat:	Bonding Primer	69
	2nd Coat:	Alkyd	47
	3rd Coat:	Alkyd	47

3.8 COLOURS

.1 Refer to Section 23 05 43 (Article 3.2.3) for colours associated with mechanical systems.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 35 29 - Work Site Safety

.3 Section 01 74 23 - Final Cleaning.

.4 Section 09 91 30 – Painting of Mechanical and Electrical Work

1.2 REFERENCES

.1 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 The Master Painters Institute (MPI)

.1 Maintenance Repainting Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for paint products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit digital copies of WHMIS MSDS in accordance with Section 01 35 29 - Work Site Safety.

.3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store painting materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.

.4 Fire Safety Requirements:

.1 Supply one (1) fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.5 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 50 00 - Temporary Facilities & Controls.

.2 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.3 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.

.2 Test concrete surfaces for alkalinity as required.

.3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

.3 Additional application requirements:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

1.6 MATERIALS

.1 Supply paint materials for paint systems from single manufacturer.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

.3 Materials in accordance with MPI - Maintenance Repainting Manual "Approved Product" listing.

.4 Colours:

.1 Match existing wall and floor colours.

.2 Refer to Section 23 05 43 (Article 3.2.3) for colours associated with mechanical systems.

.5 Mixing and tinting:

.1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Use and add thinner in accordance with paint manufacturer's recommendations.

.3 Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.6 Gloss/sheen ratings:

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss	**Gloss Degrees @ 60**	**Sheen Degree @ 85**	**Level Category**
Gloss Level 1	Max. 5	Max. 10	Matte Finish
Gloss Level 2	Max. 10	10 to 35	Velvet
Gloss Level 3	10 to 25	10 to 35	Eggshell
Gloss Level 4	20 to 35	Min. 35	Satin
Gloss Level 5	35 to 70		Semi-Gloss
Gloss Level 6	70 to 85		Gloss
Gloss Level 7	More than 85		High-Gloss

.7 Exterior re-painting:

.1 Concrete Vertical Surfaces: (including horizontal soffits)

.1 REX 3.1A – Latex (match existing gloss) finish.

.8 Interior re-painting: please confirm existing finishes and gloss levels

.1 Concrete vertical surfaces: walls.

.1 RIN 3.1E – Latex (match existing gloss) finish

.2 Concrete horizontal surfaces: floors.

.1 RIN 3.2C – Epoxy finish

Part 2 Execution

2.1 GENERAL

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Perform preparation and operations for interior painting in accordance with MPI - Maintenance Repainting Manual except where specified otherwise.

2.2 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

2.3 PREPARATION

.1 Protection of in-place conditions:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.4 Clean and prepare surfaces in accordance with MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

2.4 APPLICATION

.1 Paint only after prepared surfaces have been accepted by Departmental Representative

.2 Use brush and roller application.

.3 Apply coats of paint in continuous film of uniform thickness.

.1 Repaint thin spots or bare areas before next coat of paint is applied.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.7 Mechanical/Electrical Equipment:

.1 Refer to Section 09 91 30 – Painting of Mechanical and Electrical Work

.2 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.

.3 Do not paint over nameplates.

.4 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

2.5 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 23 - Final Cleaning.

.3 Place paint and primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

2.6 SCHEDULE

.1 Paint existing surfaces where they have been damaged by the Work of the Contract.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Drawings to show:

.1 Mounting arrangements.
.2 Operating and maintenance clearances.

.3 Drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify current model production.
.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.
.2 Description of systems and their controls.
.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for systems and component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified.
.4 Testing, adjusting and balancing reports.

.5 Approvals:

.1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
.2 Make changes as required and re-submit as directed by Departmental Representative.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Departmental Representative will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
.3 Use different colour waterproof ink for each service.
.4 Make available for reference purposes and inspection.

.8 As-Built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
.2 Identify each drawing in lower right-hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
.3 Submit to Departmental Representative for approval and make corrections as directed.
.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One (1) set of packing for each pump.

.2 One (1) casing joint gasket for each size pump.

.3 Provide one (1) set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off the ground, indoors, in dry location and in accordance with manufacturer's recommendations in a clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products – Not Applicable

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 installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 30.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers.

3.4 FIELD QUALITY CONTROL

.1 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 as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.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.

3.5 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Fire Pump.

.2 Tank Level Controls.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Departmental Representative will record these demonstrations on video tape for future reference.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Sections 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Indicate on drawings:

.1 Mounting arrangements.
.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify current model production.
.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage 75% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.
.2 Description of systems and their controls.
.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for systems and component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 21 30 00.

.5 Approvals:

.1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative DCC Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Departmental Representative will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-Built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right-hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One (1) set of packing for each pump.

.2 One (1) casing joint gasket for each size pump.

.3 One (1) glass for each gauge glass.

.3 Provide one (1) set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.4 Furnish one (1) commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products – Not Applicable

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 installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 30.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 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 as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.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.

3.5 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems.

.1 Fire Pump.

.2 Tank Level Control.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Departmental Representative will record these demonstrations on video tape for future reference.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 National Fire Protection Association (ANSI/NFPA)

.1 NFPA 20- 2010, Standard for the Installation of Stationary Fire Protection.

.2 Underwriters' Laboratories of Canada (ULC).

.3 CSC Technical Criteria 2015.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fire pump control and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide drawings for fire pump controller stamped and signed by professional engineer registered or licensed in the Province of Alberta, Canada.

.2 Indicate:

.1 Method of anchorage
.2 Number of anchors.
.3 Supports.
.4 Reinforcement.
.5 Assembly details.
.6 Accessories.
.7 Indicate hydraulic and electrical characteristics including Net Positive Suction Head (NPSH) required, make and model number.

.3 Provide power and control diagrams.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.

1.4 EXTRA MATERIALS

.1 Extra Materials:

.1 Furnish spare parts for each pump in accordance with Section 01 78 00 Closeout Submittals and as follows:

.1 One (1) set of packing.
.2 One (1) casing joint gasket.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.1 Test reports:

.1 Submit certified test reports for packaged fire pumps from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.2 Test each pump/driver package at factory to provide detailed performance data and to demonstrate compliance with NFPA and specification. Submit certified test curves for approval of Departmental Representative and Consultant.

.3 Test hydrostatically to meet requirements of fire protection system to which it will be connected.

.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.

.4 Manufacturer's Field Reports: manufacturer's field reports specified.

.2 Qualifications:

.1 Installer: company or person specializing in packaged fire pump installations with documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Packaging Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 WARRANTY

.1 Pumps to have two (2) year extended warranty.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Select fire pump to satisfy fire protection system requirements and NFPA 20.

.2 Water supply:

.1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for basis of design including NPSH available, and in accordance with NFPA 20.

.2 Base design on NFPA 20 and water flow rate of 130 L/s and residual pressure of 690 kPa at pump outlet.

2.2 FIRE PUMP

.1 Packaged, ULC, CSA listed and labelled horizontal shaft centrifugal fire pump and controller.

.2 Driver: electric drip-proof totally enclosed motor

.3 Mounting: install pump and driver on common base.

.4 Materials and construction: to NFPA 20.

.5 Capacity: as indicated:

.1 Flow rate: 63.1 L/s.
.2 Pressure: 689 kPa.

.6 Accessories to NFPA 20 requirements and in addition:

.1 Fire pump bypass fitted with shut-off valves and check valves.
.2 Audible and visual suction side alarm.
.3 OS&Y valves on suction and shut-off valves on discharge, electrically supervised.

.7 Anchor bolts and templates:

.1 Supply for installation by others.
.2 Size anchor bolts to withstand seismic zone four (4) acceleration and velocity forces.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with ULC listing, NFPA 20, manufacturer's instructions and reviewed shop drawings.

.2 Align pump and motor shafts to within manufacturer's recommended clearances prior to start-up.

.3 Install wiring in accordance with manufacturer's instructions and applicable codes.

3.3 FIELD QUALITY CONTROL

.1 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 as described in PART 1 - SUBMITTALS.

.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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.2 Site Tests:

.1 Field test each fire pump, driver and controllers in accordance with NFPA 20. Testing to include:

.1 Verification of proper installation, system initiation adjustment and fine tuning.

.2 Verification of the sequence of operations and alarm systems.

.2 Testing to be witnessed by authority having jurisdiction.

.3 Develop, with Departmental Representative and Consultant, detailed instructions for O & M installation.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Clean installed products in accordance to manufacturer's recommendation.

.3 Waste Management: separate waste materials for in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for booster pump and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Indicate on drawings:

.1 Mounting arrangements.
.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify current model production.
.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for booster pump for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.2 Operation data to include:

.1 Control schematics for systems.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Approvals:

.1 Submit digital copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.

.2 Make changes as required and re-submit as directed by Consultant.

.5 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.6 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right-hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.7 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide one (1) set of special tools required to service equipment as recommended by manufacturers.

.3 Furnish one (1) commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect booster pump from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products – Not Applicable

Part 3 Execution

3.1 SYSTEM CLEANING

.1 Clean interior and exterior of all domestic water piping and valves.

3.2 DEMONSTRATION

.1 Departmental Representative and Consultant will witness equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Fire pump.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of booster pump during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

.5 Instruction duration time to be one (1) day.

3.3 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
.2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
.3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
.4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 ASTM International Inc.

.1 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.2 ASTM A 536-84(2004)e1, Standard Specification for Ductile Iron Castings.
.3 ASTM B 88M-05, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International)

.1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-02a, Butterfly Valves.
.2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.7 National Research Council (NRC)/Institute for Research in Construction

.1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

.8 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates padding and packaging materials.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.2 Above ground: copper tube, hard drawn, type L M: to ASTM B 88M.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.

.6 NPS 1 1/2 and smaller: wrought copper to ANSI/ASME B16.22; with stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

.1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A 307, heavy series.

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 2 1/2 and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

2.5 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 2 1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, regrind seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with Province of Alberta Plumbing Code and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.3 VALVES

.1 Isolate equipment, fixtures and branches with gate valves.

3.4 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

.1 Flush entire system for eight (8) hours. Ensure outlets flushed for two (2) hours. Let stand for twenty-four (24) hours, then draw one (1) sample. Submit to testing laboratory to verify that system is clean copper to Provincial potable water guidelines. Let system flush for additional two (2) hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.7 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

.2 Upon completion, provide laboratory test reports on water quality for AHS and Consultant approval.

3.8 START-UP

.1 Timing: start-up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Monitor piping HWC piping systems for freedom of movement, pipe expansion as designed.

.4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Sterilize HWC systems for Legionella control.

.4 Verify performance of temperature controls.

.5 Verify compliance with safety and health requirements.

.6 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

Part 1 Intent

.1 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances.

.2 Contract documents of this Division and M Series Drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are **not** detailed installation instructions.

.3 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.4 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.

.5 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Departmental Representative. Uncrate equipment, move in place and install complete; start-up and test.

Part 2 Materials

.1 Materials and equipment installed shall be new, full weight and of quality specified. Use same brand or manufacturer for each specific application.

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

.3 Each major component of equipment shall bear manufacturer's name, address, catalog and serial number in a conspicuous place.

Part 3 Metric Conversion

.1 All units in this division are expressed in SI units.

.2 Submit all shop drawings and maintenance manuals in SI units.

.3 On all submittals (shop drawings etc.) use the **same** SI units as stated in the specification.

Part 4 Cutting and Patching

.1 Provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Obtain written approval from Departmental Representative before cutting or burning structural members.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm in diameter. Field-cut smaller than 100 mm.

.5 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

Part 5 Shop Drawings

.1 Comply with requirements of Division 01.

.2 Provide shop drawings as indicated.

.3 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Do not assume applicable catalogues are available in the Departmental Representative's office. Maintenance and operating manuals are not suitable submittal material.

.4 Clearly mark submittal material using arrows, underlining or circling to show differences from specified, e.g. ratings, capacities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps seals materials or painting.

.5 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, and service connection data and motor sizes.

.6 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by Departmental Representative.

.7 Shop drawings not requested will not be reviewed and processed by the Departmental Representative.

.8 Do not order equipment or material until Departmental Representative has reviewed and returned shop drawing.

Part 6 Products Options and Substitutions

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

Part 7 Performance Verification of Installed Equipment

.1 Installed mechanical equipment whose performance is questioned by Departmental Representative, may be subject to performance verification as specified herein.

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 Departmental Representative will determine by whom testing shall be carried out. When requested, arrange for services of an independent testing agency.

.4 Testing procedures shall be approved by Departmental Representative.

.5 Maintain building comfort conditions when equipment is removed from service for testing purposes.

.6 Promptly provide Departmental Representative with all test reports.

.7 Should test results reveal that originally installed equipment meets specified performance requirements, Departmental Representative will pay all costs resulting from performance verification procedure.

.8 Should test results reveal that equipment does **not** meet specified performance requirements, equipment will be rejected and the following shall apply:

.1 Remove rejected equipment. Replace with equipment which meets requirements of Contract Documents including specified performance requirements.

.2 Replacement equipment will be subject to performance verification as well, using same testing procedures on originally installed equipment.

.3 Contractor shall pay all costs resulting from performance verification procedure.

Part 8 Project Record Drawings

.1 Submit record drawings identifying location of EMCS sensors, tagged valves and actual room names or numbers.

Part 9 Equipment Protection and Clean-Up

.1 Protect equipment and materials in storage on-site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

Part 10 Temporary or Trial Usage

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

Part 11 Electrical Motors

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40°C for open housing and 50°C for drip proof housing, and operate at 1200 or 1800 r/min unless otherwise specified.

.3 Motors shall have ball or roller type bearings.

.4 Provide grease lubrication fittings on motors with frame sizes 254T and larger.

.5 Refer to electrical specification for voltage, phase and cycle.

END OF SECTION

Part 1 **General – Not Applicable**

Part 2 **Products**

2.1 **SPARE PARTS AND MAINTENANCE MATERIALS SCHEDULE**

Item	Quantity
Pump Seals:	One (1) for each pump.
Valves:	
Washers:	One (1) for each valve size and type.
Seats:	One (1) for each valve size and type.

Part 3 **Execution**

3.1 **DELIVERY**

.1 Deliver spare parts and maintenance materials to project site or other location designated by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International

.1 ASTM A 276-08, Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM B 62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B 283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B 505/B 505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Submit data for valves specified in this Section.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:

.1 Valve seats: one (1) for every four (4) valves each size, minimum one (1).
.2 Stem packing: one (1) for every four (4) valves, each size, minimum one (1).
.3 Valve handles: two (2) of each size.
.4 Gaskets for flanges: one (1) for every four (4) flanged joints.

.2 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

.1 Valves:

.1 Except for specialty valves, to be single manufacturer.
.2 Products to have CRN registration numbers.

.2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
.2 Copper tube systems: solder ends to ANSI/ASME B16.18.

.3 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hexagonal shoulders.
.3 Connections: screwed with hexagonal shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: non-asbestos.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B 62.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel.

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: handwheel.

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.
.2 Disc: split wedge, bronze to ASTM B 283, loosely secured to stem.
.3 Operator: handwheel.

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.
.2 Operator: handwheel.

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet.
.2 Operator: handwheel.

.4 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.
.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
.2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B 62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.1-05, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ASTM International Inc.

.1 ASTM A 49-01(2006), Standard Specification for Heat-Treated Carbon Steel Joint Bars.
.2 ASTM A 126-04, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
.3 ASTM A 536-84(2004)e1, Standard Specification for Ductile Iron Castings.
.4 ASTM B 61-08, Standard Specification for Steam or Valve Bronze Castings.
.5 ASTM B 62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
.6 ASTM B 85/B 85M-08, Standard Specification for Aluminum-Alloy Die Castings.
.7 ASTM B 209-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS SP-61-03, Pressure Testing of Steel Valves.
.2 MSS SP-70-06, Grey Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS SP-71-05, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS SP-82-1992, Valve Pressure Testing Methods.
.5 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:

.1 Valve seats: one (1) for every four (4) valves each size, minimum one (1).
.2 Discs: one (1) for every four (4) valves, each size, minimum one (1).
.3 Stem packing: one (1) for every four (4) valves, each size, minimum one (1).
.4 Valve handles: two (2) of each size.
.5 Gaskets for flanges: one (1) for every four (4) flanged joints.

.2 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

Part 2 Products

2.1 MATERIAL

.1 Valves:

.1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:

.1 Gate valves: MSS SP-70.
.2 Globe valves: MSS SP-85.
.3 Check valves: MSS SP-71.

.3 Requirements common to valves, unless specified otherwise:

.1 Body, bonnet: cast iron to ASTM B 209 Class B.
.2 Connections: flanged ends plain face to ANSI B16.1.
.3 Inspection and pressure testing: to MSS SP-82.
.4 Bonnet gasket: non-asbestos.
.5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
.7 Gland packing: non-asbestos.
.8 Handwheel: die-cast aluminum alloy to ASTM B 85/B 85M or malleable iron to ASTM A 49. Nut of bronze to ASTM B 62.
.9 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non-rising stem, inside screw, bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.
.2 Disc: solid offset taper wedge, bronze to ASTM B 62.
.3 Seat rings: renewable bronze to ASTM B 62, screwed into body.
.4 Stem: bronze to ASTM B 62.
.5 Disc: solid offset taper wedge, cast iron to ASTM A 126 Class B, secured to wrought steel stem.
.6 Seat: integral with body.
.7 Stem: wrought steel.
.8 Operator: handwheel.

.2 NPS 10 - 24, non-rising stem, inside crew, bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: cast iron to ASTM A 126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.
.2 Pressure ratings: Class 125.
.3 Disc: solid offset taper wedge, with bronze rings to ASTM B 62 rolled into cast iron disc, secured to stem.
.4 Seat rings: renewable bronze to ASTM B 62 screwed into body.
.5 Stem: bronze to ASTM B 62.
.6 Disc: solid offset taper wedge, cast iron secured to stem.
.7 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.
.8 Stem: wrought steel.
.9 Operator: handwheel.

.3 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.
.2 Disc: solid offset taper wedge, bronze to ASTM B 62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
.3 Seat rings: renewable bronze screwed into body.

.4 Stem: nickel-plated steel.
.5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.
.6 Seat rings: integral with body.
.7 Stem: nickel-plated steel.
.8 Pressure-lubricated operating mechanism.
.9 Operator: handwheel.

.4 NPS 10 - 24, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: NPS 10 - 14: cast iron to ASTM A 126 Class B. With bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges, yoke, yoke hub, yoke sleeve and nut.
.2 Pressure ratings: Class 125.
.1 NPS 10-12: WP = 1.4 MPa CWP.
.2 NPS 14-24: WP = 1.03 MPa CWP.
.3 Disc: solid offset taper wedge, bronze disc rings to ASTM B 62 rolled into cast iron disc, secured to stem through integral forged T-head disc-stem connection.
.4 Seat rings: renewable bronze to ASTM B 62 screwed into body.
.5 Stem: nickel-plated steel.
.6 Disc: solid offset tapper all-cast iron, secured to stem through integral forged T-head disc-stem connection.
.7 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.
.8 Stem: nickel-plated steel.
.9 Pressure-lubricated operating mechanism.
.10 Operator: handwheel.

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:

.1 Approvals: UL and FM approved for fire service.
.2 UL and FM Label: on valve yoke.
.3 Body, Bonnet: cast iron to ASTM A 126 Class B. Wall thicknesses to ANSI B16.1 and ULC C-262 (B).
.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
.5 Packing gland: bronze.
.6 Stem: manganese bronze. Diameter to ULC C-262 (B).
.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
.8 Bosses for bypass valve, drain: on NPS 4 and over.
.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: EPDM coated cast iron with bronze disc rings.
.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.

.11 Pressure rating:

.1 NPS 2-1/2 - 12: 1.7 MPa CWP.
.2 NPS 14-1.2: 1.2 MPa CWP.

.12 Operator: handwheel.

.13 Bypass: complete with union and NPS gate valve as Section 23 05 23.01 - Valves - Bronze.

2.4 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:

.1 Body: with multiple-bolted bonnet.
.2 WP: 860 kPa steam, 1.4 MPa CWP.
.3 Bonnet-yoke gasket: non-asbestos.
.4 Disc: bronze to ASTM B 62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
.5 Seat ring: renewable, regrindable, screwed into body.
.6 Stem: bronze to ASTM B 62.
.7 Operator: handwheel.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:

.1 Main valve up to NPS 8: NPS 3/4.
.2 Main valve NPS 10 and over: NPS 1.

.4 Type of bypass valves:

.1 On gate valve: globe, with bronze disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.

.2 On globe valve: globe, with bronze disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.

2.6 VALVE OPERATORS

.1 Install valve operators as follows:

.1 Handwheel: on valves except as specified.

2.7 CHECK VALVES

.1 Swing check valves, Class 125:

.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Grooved or flanged ends: plain faced with smooth finish.

.1 Up to NPS 16: cast iron to ASTM A 126 Class B.
.2 NPS 18 and over: cast iron to ASTM A 126 Class C.

.2 Ratings:

.1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.
.2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.
.3 NPS 18 and over: 1.03 MPa CWP.

.3 Disc: rotating for extended life.

.1 Up to NPS 6: bronze to ASTM B 62.
.2 NPS 8 and over: bronze-faced cast iron.

.4 Seat rings: renewable bronze to ASTM B 62 screwed into body.

.5 Hinge pin, bushings: renewable bronze to ASTM B 62.

.6 Disc: A126 Class B, secured to stem, rotating for extended life.

.7 Seat: cast iron, integral with body.

.8 Hinge pin: exelloy; bushings: malleable iron.

.9 Identification tag: fastened to cover.

.10 Hinge: stainless steel.

.2 Swing check valves, NPS 2 1/2 - 8 Class 250:

.1 Body and bolted cover: cast iron to ASTM A 126 Class B with tapped and plugged opening on each side for hinge pin.

.2 Flanged ends: 2 mm raised face with serrated finish.

.3 Rating: 250 psi steam; 500 psi CWP.

.4 Disc: rotating for extended life.

.1 Up to NPS 3: bronze to ASTM B 61.
.2 NPS 4 - 8: iron faced with ASTM B 61 bronze.

.5 Seat rings: renewable bronze to ASTM B 61, screwed into body.

.6 Hinge pin, bushings: renewable, bronze to ASTM B 61.

.7 Hinge: galvanized malleable iron.

.8 Identification tag: fastened to cover.

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

END OF SECTION

Part 1 General

1.1 REFERENCE DOCUMENTS

.1 American National Standards Institute (ANSI):

.1 ANSI/ASME B31.1-2004 Power Piping

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A653/A653M-09 Standard Specification for Sheet Steel, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.40-M89 Primer, Structural Steel, Oil Alkyd Type

1.2 GENERAL REQUIREMENTS

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction and to accommodate insulation; provide insulation protection saddles.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building steel or inserts in concrete construction.

.5 Provide and set sleeves required for equipment, including openings required for placing equipment.

.6 Dielectrically isolate dissimilar metals.

1.3 APPROVALS

.1 Obtain approval from the Departmental Representative prior to drilling for inserts and supports for piping systems.

.2 Obtain approval from the Departmental Representative prior to using percussion type fastenings.

.3 Use of existing piping or equipment for hanger supports is not permitted.

.4 Use of perforated band iron, wire or chain as hangers is not permitted.

Part 2 Products

2.1 INSERTS

.1 Inserts shall be malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers: Pipe sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes 150 mm Over: Adjustable wrought steel clevis.

.3 Hangers: Hot Pipe Sizes 150 mm and Over: Adjustable steel yoke and cast iron roll.

.4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.

.5 Wall Support: Pipe Sizes to 80 mm: Cast iron hook.

.6 Wall Support: Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.

.7 Vertical Support: Steel riser clamp.

.8 Floor Support: Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.9 Floor Support: Hot Pipe Sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

.10 Design hangers so they cannot become disengaged by movements of supported pipe.

.11 Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

.12 Insulate aluminum piping from dissimilar metal supports.

2.3 HANGER RODS

.1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

2.4 FLASHING

.1 Steel Flashing: 0.55 mm galvanized steel.

.2 Lead Flashing: sheet lead, as follows:

.1 For Waterproofing: 25 kg/m^2.

.2 For Soundproofing: 5 kg/m^2.

.3 Lead Sheet Size:

.1 Roof Drains: minimum 810 mm x 810 mm.

.2 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.

.3 Floor Drains: minimum 920 x 920 mm and as specified.

.4 Other Locations: as specified.

.3 Safes: 25 kg/m^2 sheet lead or 200 micrometre neoprene.

.4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.5 SLEEVES

.1 Pipes through Floors: Form with 1.2 mm galvanized steel.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe or 1.2 mm thickness galvanized steel.

.3 Size large enough to allow for expansion with continuous insulation.

2.6 FINISHES ON HANGER RODS, HANGERS AND SUPPORTS

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

Part 3 Execution

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size	Distance Between Supports	Hanger Rod Diameter
15 mm	1.8 m	10 mm
20 mm to 40 mm	1.8 m	10 mm
50 mm & 65 mm	3 m	10 mm
80 mm & 100 mm	3.6 m	16 mm
150 mm to 300 mm	4.3 m	22 mm
350 mm to 450 mm	6.1 m	25 mm

.2 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

3.3 EQUIPMENT BASES AND SUPPORTS

.1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

3.4 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Identification for mechanical equipment, piping systems and related components.

1.2 QUALITY CONTROL

.1 Coordinate painting of piping and equipment with work of Section 09 91 30.

.2 Colour Code mechanical equipment, piping and exposed ductwork. Refer to label identification schedules.

.3 Submit a schedule of pipe and equipment identification methods, materials and colours to the Departmental Representative for review.

1.3 REFERENCE STANDARDS

.1 ASME A13.1 – Scheme for the Identification of Piping Systems.

.2 CAN/CGSB-24.3 – Identification of Piping Systems.

.3 Federal Standard 595C Colours.

.4 WHMIS Pictograms – Workplace Hazardous Materials Information System – GHS (Globally Harmonized System of Classification and Labelling Chemicals) – Pictograms.

Part 2 Products

2.1 IDENTIFICATION LABELS

.1 Identification Labels for all mechanical piping and ductwork systems, to include:

.1 WHMIS Pictogram (as applicable), same colour as legend letters.

.2 A lettered legend on a coloured background, defining the contents in the pipe, its pressure and temperature and the information necessary to define the hazard.

.3 Arrows to define the direction of flow, same colour as legend letters.

.4 50 mm wide black tape at each end of the label, wrapped around the entire circumference of pipe/insulation to secure the Identification Labels.

.2 Identification Labels may be accomplished by paint, stenciling and/or factory fabricated labels. Labels shall cover full circumference of pipe or insulation.

2.2 LEGEND LETTERS AND NUMBERS

.1 Height of Legend Letters and Numbers:

Outside Diameter of Pipe or Covering (mm)	Height of Letters and Numbers (mm)	Length of Colour Field (mm)
19 to 32	13	200
38 to 51	19	200
64 to 150	32	300
200 to 250	64	600
Over 250	89	800

.2 Lettering and Direction of Flow Arrow:

.1 Lettering: Capital, Bold, Sans Serif, Century Gothic or Helvetica.

.2 For hazardous piping system: black letters and arrows.

.3 Fire protection, other piping systems and ductwork: white letters and arrows, unless otherwise specified.

2.3 VALVE TAGS, DIRECTORIES AND NAMEPLATES

.1 Valve tags: 40 mm diameter with 20 mm lettering: brass, lamicoid or metal photo black numbers, secured to valve stem with key chain.

.2 Valve Directories: laminated sheets and electronic copy. Include the following information for each tagged valve:

.1 Valve identified (valve number or logical point mnemonic).
.2 Location.
.3 Service.
.4 Make/model/size and CV for control valves.

.3 Engraved Plastic Nameplates: self-adhesive composite laminated plastic nameplates with one smooth white surface and core of black plastic designed to leave black lettering on a white background. Engraved lettering height as follows:

.1 All major equipment: 20 mm
.2 Magnetic contactors and VFDs: 20 mm
.3 All other: 8 mm

Part 3 Execution

3.1 GENERAL

.1 Identify piping systems with Identification Labels. Refer to Article 3.2 Identification Schedules.

.2 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots". The colours shall conform to the following schedule:

.1	Plumbing equipment and valves	Green
.2	Control dampers and sensors	Black

3.2 IDENTIFICATION SCHEDULES

.1 Colour numbers for Identification Labels on piping systems, valves and equipment are defined in Federal Standard 595C Colours for colour code identification.

- Black : 17038
- Yellow : 13591
- Green : 14193
- Orange : 12473
- Brown : 10115
- Red : 11350
- White : 17860
- Aluminum : 16515
- Blue : 15180
- Grey : 16293
- Light Blue : 15450
- Purple : 17155

.2 Pipe Identification Label Schedule:

Service	Background	Lettering	WHMIS Symbol	Legend
Diesel Fuel Oil	Yellow	Black	Yes	DIESEL FUEL OIL
Domestic Cold Water	Light Blue	White	N/A	DOMESTIC COLD WATER
Drains	Aluminum	Green	N/A	DRAIN
Vent	Aluminum	Green	N/A	VENT

.3 Equipment Bases/Housekeeping Pads:

.1 Grey, with 100 mm yellow and black angled bands around edges.

3.3 LOCATION OF LABELS

.1 Orient labels on piping systems in visual sight lines while standing at floor levels.

.2 Locate labels as follows:

.1 Upstream of valves.
.2 Adjacent to changes in direction.
.3 Branches.
.4 Where pipes pass through walls or floors.
.5 On straight pipe runs at 6 m intervals.
.6 For natural gas and propane piping systems, at 6 m intervals on straight pipe runs.
.7 Where system is installed in pipe chases, ceiling spaces, shafts, or similar confined spaces, at entry and exit points and at access openings
.8 At beginning and end points of each run and at each piece of equipment.

.3 Adhere labels to piping/insulation. Labels to cover entire pipe circumference. Secure both ends of labels with 50 m wide black tape around the entire pipe circumferences.

3.4 MECHANICAL CONTROL IDENTIFICATION

.1 Refer to Section 25 09 28 - EMCS Field Work.

3.5 RECORD PROVISIONS

.1 Mark valve numbers on Red-Line system schematic drawings for transfer onto record drawings. Include copies of Operation and Maintenance Manuals.

3.6 VALVE TAGS

.1 Tag pneumatic/electric controls, instruments and relays. Key to control schematics on which instruments are numbered in sequence.

.2 Tag all valves in mechanical rooms.

.3 Tag all control valves external to mechanical rooms. This includes control valves on radiant panels, perimeter radiation and air terminal boxes.

.4 Tag all circuit balancing and isolating valves external to mechanical rooms except valves at terminal heating and cooling equipment.

.5 Identify and tag pneumatic/electric thermostats relating to terminal unit and valve numbers.

3.7 VALVE DIRECTORIES

.1 Include laminated directories in operation and maintenance manuals. Also provide electronic copy in PDF, as well as spreadsheet user editable format.

3.8 NAMEPLATES

.1 Identify the following with engraved plastic nameplates:

.1 All mechanical equipment.

.2 Electric starting switches, electric disconnects, remote push buttons and control panels.

.2 All nameplates to be mechanically fastened, easily visible without need to use ladder or extraordinary body position. Affix additional nameplates if necessary.

.3 Provide the Departmental Representative with an example of the contents of each type of nameplate. Obtain approval prior to engraving.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM B 209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

.2 ASTM C 335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C 411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C 449/C 449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C 533-2004, Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C 547-2003, Mineral Fiber Pipe Insulation.

.7 ASTM C 795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C 921-03a, Standard Practice for Determining the Properties of Jacketting Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
.2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings.
.4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC SS:

.1 CRF: Code Rectangular Finish.
.2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.4 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Departmental Representative will make available one (1) copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this Section, and have at least three (3) years successful experience in this size and type of project, member of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702.
.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

.7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C 533.
.2 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Air drying on mineral wool, to ASTM C 449/C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/mý.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: to match adjacent finish.

.3 Minimum service temperatures: -20 degrees C.

.4 Maximum service temperature: 65 degrees C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: 0.75 mm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 ABS Plastic:

.1 One-piece moulded type and sheet with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.

.3 Minimum service temperatures: -40 degrees C.

.4 Maximum service temperature: 82 degrees C.

.5 Moisture vapour transmission: 0.012 perm.

.6 Thickness: 0.75 mm.

.7 Fastenings:

.1 Solvent weld adhesive compatible with insulation to seal laps and joints.
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.

.8 Locations:

.1 For outdoor use ONLY.

.3 Canvas:

.1 220 gm/mý cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: compatible with insulation.

.4 Aluminum:

.1 To ASTM B 209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: smooth.

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.5 Stainless steel:

.1 Type: 304.

.2 Thickness: 0.25 mm.

.3 Finish: smooth.

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 Use two (2) layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-3.

.1 Securements: SS bands Tape at 300 mm on centre.
.2 Seals: VR lap seal adhesive, VR lagging adhesive.
.3 Installation: TIAC Code 1501-C.

.3 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp Degrees C	TIAC Code	Pipe Sizes (NPA) and Insulation Thickness (mm)					
		To 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 and Over		
Domestic CWS		[A-3]	25	25	25	25	25	25`

.4 Finishes:

.1 Exposed in mechanical rooms: SS jacket.
.2 Concealed, indoors: canvas on valves, fittings. No further finish.
.3 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
.4 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE DOCUMENTS

.1 American Society for Testing and Materials (ASTM)

.1	ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
.2	ASTM C335	Steady State Heat Transfer Properties of Pipe Insulation
.3	ASTM C411	Hot-Surface Performance of High Temperature Thermal Insulation
.4	ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulating and Finishing Cement
.5	ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
.6	ASTM C534	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
.7	ASTM C547	Mineral Fiber Pipe Insulation
.8	ASTM C553	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
.9	ASTM C612	Mineral Fiber Block and Board Thermal Insulation
.10	ASTM E96	Water Vapor Transmission of Materials

.2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1	ASHRAE Standard 90.1	Energy Standard for Buildings except Low Rise Residential Buildings

.3 Thermal Insulation Association of Canada (TIAC)

.1 Mechanical Insulation Best Practices Guide.

.4 Underwriters Laboratories Canada (ULC)

.1	CAN/ULC-S102	Surface Burning Characteristics of Building Materials and Assemblies
.2	CAN/ULC-S102.2	Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies
.3	CAN/ULC-S701	Thermal Insulation, Polystyrene, Boards and Pipe

1.2 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.3 SUBMITTALS

.1 Product Data

.1 Submit manufacturer's product data in accordance with Section 01 33 00 – Submittal Procedures, and Section 23 00 13 – Mechanical General Requirements.

.1 When requested, submit product data and test reports indicating that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements.

.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures, and Section 23 00 13 – Mechanical General Requirements.

.1 For each application submit an insulation schedule to include the following information:

.1 Materials
.2 "k" value
.3 Thickness
.4 Density
.5 Finish
.6 Jacketing

.3 Submit information showing installed insulation and membrane products meet the requirements of ASHRAE 90.1-2010.

1.4 DEFINITIONS

.1 For the purposes of this Section, the following definitions apply:

.1 Concealed: piping systems and equipment in trenches, shafts, furring, and suspended ceilings.

.2 Exposed: piping systems and equipment in mechanical rooms or otherwise not "concealed".

.3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

1.5 FLAME/SMOKE DEVELOPMENT RATINGS

.1 Pipe insulations, recovery materials, tapes, vapor barrier facings and adhesives shall have maximum flame spread rating of 25 and maximum smoke developed rating of 50, when tested in accordance with CAN/ULC-S102 and/or CAN/ULC-S102.2.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and store materials in original packaging with manufacturer's labels.

.2 Protect materials against damage from weather and construction activities.

Part 2 Products

2.1 COLD PIPE INSULATION

.1 Cold Pipe Insulation: Mineral Fibre:

.1 Material: formed mineral fibre rigid insulation sleeving to ASTM C547.
.2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
.3 Service Temperature: -14°C to 100°C.
.4 Jacket: factory applied vapor barrier jacket to ASTM E96, with longitudinal lap seal.

.2 Cold Pipe Insulation - Black Rubber:

.3 Material: flexible elastomeric unicellular preformed pipe covering to ASTM C534.

.4 "k" Value: 0.04 W/m. °C at 24°C mean temperature.

.5 Service Temperature: -4°C to 100°C.

.6 Maximum Allowable Thickness: 25 mm.

2.2 ACCESSORIES

.1 For mineral fibre insulation materials:

.1 FSK Tape: vapour barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self-adhesive.

.2 ASJ Tape: vapour resistant tape consisting of all service jacket material with pressure sensitive self-adhesive.

.3 Adhesive: quick setting adhesive for joints and lap sealing.

.2 Black Rubber Insulation Adhesive: manufacturer's recommended contact cement.

.3 Thermal Insulating and Finishing Cement: to ASTM C449 mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.

2.3 RECOVERY MATERIALS

.1 Canvas: ULC listed, 220 g/m^2 plain weave cotton fabric.

.2 Aluminum: to 0.4 mm thick smooth with longitudinal slip joints and 50 mm end laps, 0.4 mm thick die shaped fitting covers with factory attached protective liner on interior surface.

.3 PVC: 0.4 mm thick for interior use, white in colour with one-piece pre-moulded fitting covers.

.4 Black Rubber Finish: insulation manufacturers recommended vinyl lacquer type coating.

Part 3 Execution

3.1 INSTALLATION, GENERAL

.1 Apply insulation after required piping system tests have been completed, witnessed and certified.

.2 Ensure piping surface is clean and dry before insulating.

.3 Install in accordance with TIAC Mechanical Insulation Best Practices Guide.

.4 Install in accordance with manufacturer's recommendations.

.5 Ensure insulation is continuous through walls and floor penetrations.

.6 Locate cover seams in least visible locations.

.7 Stagger butt joints where multi-layered insulation is used.

.8 On vertical piping with diameters 25 mm and larger, use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Repeat supports on 4.5 m centers and at each valve and flange.

.9 Tightly fit insulation sections to pipe to make smooth and even surfaces. Cut insulation for proper fit where weld beads protrude. Bevel away from studs and nuts to allow their removal without damage to insulation. Trim closely and neatly around extending parts of pipe saddles, supports, hangers, clamp guides and seal with insulating/finishing cement.

3.2 COLD PIPE INSULATION APPLICATION

.1 Insulate 5 m portion of plumbing vents measured from roof outlet back. Do not insulate remaining vent piping.

.2 Apply vapor retardant mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Apply adhesive to ends of butt joints and seal joint seams with 100 mm wide strips of joint tape.

.3 Insulate complete system including valves, unions, flanges, strainers, drains, caps and fittings. Cover fittings and valves with equivalent thickness of finishing cement. Cover finishing cement with open mesh glass cloth and vapor retardant adhesive. Seal lap joints with 100% coverage of joint tape and seal the assembly with vapor retardant adhesive. Alternatively, insulate with tightly placed flexible insulation and apply reinforcing membrane embedded in vapor retardant coating and apply PVC fitting covers.

.4 Seal black rubber insulation butt joints and seams with black rubber insulation adhesive.

.5 Recover exposed mineral fibre insulated piping with canvas.

.6 Coat exposed black rubber insulation with two (2) coats of black rubber finish material.

3.3 COLD EQUIPMENT INSULATION APPLICATION

.1 Tightly butt edges and stagger joints. Seal joints with 100 mm wide FSK tape.

.2 Cover insulation with 25 mm galvanized hexagonal mesh and 12 mm coat of finishing cement. Finish with a final 12 mm coat of finishing cement and recover with canvas.

3.4 INSULATION TYPE AND THICKNESS SCHEDULE

Insulation Type and Thickness Schedule		
Service Type and Nominal Pipe Diameter (mm)	**Application**	**Insulation Thickness (mm)**
Domestic Cold water:		
38 and smaller	Cold Pipe	12
50 and larger	Cold Pipe	25

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

1.2 DEFINITIONS

.1 CDL - Control Description Logic.

.2 For additional acronyms and definitions refer to Section 25 09 23 - EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, supplemented and modified by requirements of this Section.

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Departmental Representative thirty (30) days prior to anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show coordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit reports within one (1) week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

1.4 QUALITY ASSURANCE

.1 Provide bilingual, competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Departmental Representative reserves right to approve instructors.

1.5 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training to be project-specific.

1.6 TIME FOR TRAINING

.1 Number of days of instruction to be as specified in this section (one (1) day = eight (8) hours including two (2) fifteen (15) minute breaks and excluding lunch time).

1.7 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.8 TRAINING PROGRAM

.1 To be in 2 phases over a six (6) month period.

.2 Phase 1: two (2) day program to begin before thirty (30) day test period at time mutually agreeable to Contractor, Departmental Representative and PWGSC Commissioning Manager.

.1 Train O&M personnel in functional operations and procedures to be employed for system operation.

.2 Supplement with on-the-job training during thirty (30) day test period.

.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.

.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

.3 Phase 2: five (5) day program to begin eight (8) weeks after acceptance for operators, equipment maintenance personnel and programmers.

.1 Provide multiple instructors on pre-arranged schedule. Include at least the following:

.1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

.2 Equipment maintenance training: provide personnel with two (2) days training within five (5) day period in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventive maintenance of EMCS components, maintenance and calibration of sensors and controls.

1.9 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.10 MONITORING OF TRAINING

.1 Departmental Representative to monitor training program and may modify schedule and content.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 09 23 - EMCS: General Requirements.

1.3 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.

.1 Location of local office.
.2 Description and location of installing and servicing technical staff.
.3 Location and qualifications of programming design and programming support staff.
.4 List of spare parts.
.5 Location of spare parts stock.
.6 Names of sub-contractors and site-specific key personnel.
.7 Sketch of site-specific system architecture.
.8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
.9 Descriptive brochures.
.10 Sample CDL and graphics (systems schematics).
.11 Response time for each type of command and report.
.12 Item-by-item statement of compliance.
.13 Proof of demonstrated ability of system to communicate utilizing BACnet or Lontalk.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Submit preliminary design document within five (5) working days after tender closing and before contract award, for review by Departmental Representative.

.3 Shop Drawings to consist of three (3) hard copies and one (1) soft copy of design documents, shop drawings, product data and software.

.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

.5 Soft copy to be in Autocad - latest version and WordPerfect latest version Microsoft Word latest version format, structured using menu format for easy loading and retrieval on OWS.

1.5 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop drawings within thirty (30) working days of award of contract and include following:

.1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.

.2 Detailed system architecture showing all points associated with each controller including signal levels, pressures where new EMCS ties into existing control equipment.

.3 Spare point capacity of each controller by number and type.

.4 Controller locations.

.5 Auxiliary control cabinet locations.

.6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.

.7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).

.8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.

.9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.

.10 Compressor schematic and sizing data.

1.6 DETAILED SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within sixty (60) working days after award of contract and before start of installation and include following:

.1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.

.2 Wiring diagrams.

.3 Piping diagrams and hook-ups.

.4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.

.5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:

.1 Sensing element type and location.

.2 Transmitter type and range.

.3 Associated field wiring schematics, schedules and terminations.

.4 Pneumatic schematics and schedules.

.5 Complete Point Name Lists.

.6 Setpoints, curves or graphs and alarm limits (high and low, three (3) types critical, cautionary and maintenance), signal range.

.7 Software and programming details associated with each point.

.8 Manufacturer's recommended installation instructions and procedures.

.9 Input and output signal levels or pressures where new system ties into existing control equipment.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.

.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

.9 Listing and example of specified reports.

.10 Listing of time of day schedules.

.11 Mark-up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.12 Type and size of memory with statement of spare memory capacity.

.13 Full description of software programs provided.

.14 Sample of "Operating Instructions Manual" to be used for training purposes.

.15 Outline of proposed start-up and verification procedures.

1.7 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within forty-five (45) working days of award of contract to:

.1 Undertake functional review of preliminary design documents, resolve inconsistencies.

.2 Resolve conflicts between contract document requirements and actual items (e.g., points list inconsistencies).

.3 Review interface requirements of materials supplied by others.

.4 Review "Sequence of Operations".

.2 Contractor's programmer to attend meeting.

.3 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

Part 2 **Products – Not Applicable**

Part 3 **Execution – Not Applicable**

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Work Station.

.3 For additional acryonyms and definitions refer to Section 25 09 23 - EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.

.2 Submit Record Documents to Departmental Representative in English.

.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.4 AS-BUILTS

.1 Provide one (1) copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:

.1 Changes to contract documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 08 95 - EMCS: Start-Up & Testing.

.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Departmental Representative.

.3 Provide before acceptance four (4) hard and one (1) soft copy incorporating changes made during final review.

1.5 O&M MANUALS

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Provide two (2) complete sets of hard and soft copies prior to system or equipment tests

.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.4 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.

.5 System operation to include:

.1 Complete step-by-step procedures for operation of system including required actions at each OWS.

.2 Operation of computer peripherals, input and output formats.

.3 Emergency, alarm and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.6 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure coordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

Part 2 Products – Not Applicable

Part 3 Execution – Not Applicable

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 09 23 – EMCS: General Requirements and other related EMCS Sections.

1.2 START-UP SHEETS

.1 Following forms are available from the Departmental Representative for use in presenting start up and testing data:

.1 Physical Point Confirmation.

1.3 DOCUMENTATION

.1 Submit complete system documentation before start of testing, including:

.1 Interlock and control schematics for each system controlled, identifying each EMCS physical point by mnemonic.
.2 Table of operating set points and alarm limits for each system.
.3 Device calibration methods and procedures.
.4 list of all applicable real and virtual mnemonics, with full English description of each mnemonic.

Part 2 Products - Not Applicable

Part 3 Execution

3.1 HARDWARE

.1 Verify that each hardware component has been properly installed as recommended by manufacturer and is functioning correctly.

.2 Verify that all circuits are complete and all terminal wiring connections are tight.

.3 Electronic hardware:

.1 Start-up electronic hardware as recommended by manufacturer.
.2 Replace defective components.
.3 Prove proper operation, use software diagnostic.

.4 Interfaces:

.1 Test to ensure interfaces with Divisions 25 and 26 and other control packages are complete.

.2 Verify that interface cabinets comply with applicable codes and specified requirements.

.5 Check operation of system under failure modes:

.1 Power failure.
.2 Sensor failure.

3.2 POINT CHECK OUT

.1 Verify point mnemonic, hardware address, correct physical location and proper functioning of each hardware point on system. Record verification of each point on "Physical Point Confirmation" sheets.

.2 Calibrate all the new analogue input/output devices, actuators, transducers and sensors as recommended by manufacturer.

.3 Achieve end-to-end (between field device and actual value displayed on screen) calibration accuracy over full expected operating range as specified for each analogue point type in Section 25 09 29:

.1 Calibration may be performed on the hardware device if this feature is available, or may be entered into database/software provided correction is not greater than five (5) times specified accuracy for device. Device must be replaced and calibrated again if correction is outside this band. Combination coarse hardware and fine database/software calibration is allowed.

.2 Simple offset calibration is acceptable where the operating range is less than 25% of the device span. Slope calibration is required for devices operating over larger spans. A two-point slope calibration, where the samples are about 20% from each end of the operating range is acceptable if the resulting offset at the middle of the operating range falls within the specified accuracy.

.3 All database/software calibrations must be entered even if these fall within the specified accuracy.

.4 Document each calibration correction on "Physical Point Confirmation" Sheets.

.4 Check range and repeatability of each analogue output point. Ensure tight shut-off of dampers and valves.

3.3 TRIAL USE

.1 Fifteen (15) days before Interim Acceptance of the Work provide the Departmental Representative with full access to EMCS for Departmental Representative's trial use of system.

.2 Trial use is to determine EMCS's compliance with Specifications, and to permit Departmental Representative to verify installation and accuracy of calibration of all physical points connected to EMCS.

.3 Provide a qualified EMCS representative for five days on-site to assist with the Departmental Representative's trial use of system. NOTE: Contractor correction and repair of deficiencies does not constitute verification. Time taken for this corrective work shall not be counted towards the specified period of on-site assistance.

3.4 DEMONSTRATION OF SYSTEM INTEGRITY

.1 Prior to Interim Acceptance of the Work, demonstrate the following EMCS features to Departmental Representative:

.1 Fail-safe and emergency modes for systems.

.2 Prior to Interim Acceptance of the Work, demonstrate to the Departmental Representative all control sequences for equipment not directly controlled by EMCS, including component hard wired interlocks.

3.5 DEPARTMENTAL REPRESENTATIVE'S POINT VERIFICATION

.1 The Departmental Representative will verify all EMCS physical points for correct connection, calibration and operation after Contractor prepared "Physical Point Confirmation" sheets have been reviewed by the Departmental Representative.

.2 The Departmental Representative's point verification will be carried out during the Departmental Representative's trial usage of the system.

.3 All required trend logs and screen graphics shall be complete and fully functional prior to Departmental Representative's Point Verification.

3.6 APPLICATION SOFTWARE

.1 Ensure all hardware is installed and started and fully operational before software start-up.

.2 Enter each physical point into database and include following:

.1 Set up run time capture for each digital output.

.2 Enter engineering units for each analogue point.

.3 Set up an alarm point for each digital input/output pair, with delay before alarm is enunciated.

.4 Set up an alarm point for each analogue input with high and low limits. Provide a reset differential.

.5 Enter physical point calibration corrections.

.6 Enter analogue input conversion equations for fluid velocity measuring devices.

.3 Enter start/stop schedules for all systems not required to run continuously.

3.7 DEMONSTRATION OF APPLICATION SOFTWARE

.1 Demonstrate following to the Departmental Representative:

.1 Man/machine interface to EMCS system, including operator access, all monitoring functions and command of points.

.2 Operation of specific application software such as:

.1 Demand limiting.

.2 Peak shaving.

.3 Night setback.

.4 Optimum start of heating/cooling systems.

.5 Building dynamic control.

.6 Alarm conditions and printouts.

.7 Automatic report generation.

3.8 USER CONTROL SOFTWARE IMPLEMENTATION

.1 Demonstrate User Control Language software operation, start-up and shutdown sequences, software interlocks, fail safe, emergency shutdown and alarm condition control strategies in accordance with the requirements of Section 25 09 93.

3.9 REVIEW OF DEFICIENCIES BEFORE INTERIM ACCEPTANCE

.1 Review all deficiencies and agree upon a deficiency list with the Departmental Representative, before Interim Acceptance of the Work.

END OF SECTION

Part 1 General

1.1 INTENT

.1 This Section specifies general requirements common to all energy management and control system (EMCS) work. Read this Section in conjunction with all Sections that specify EMCS work.

1.2 PRODUCTS OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.3 ABBREVIATIONS

.1 EMCS: Energy Management Control Systems.

.2 Objects: Data constructs containing information including, but not limited to, physical or virtual points and attributes.

.3 Examples: Analogue or digital inputs, outputs and calculated values, occupancy schedules, control loops, alarms, commands, programs, etc.

1.4 CONSTRUCTION SCHEDULE

.1 Comply with requirements of Division 01.

.2 Include EMCS installation schedule as part of the construction progress schedule. Include start and finish dates for:

.1 Equipment ordering and delivery.
.2 Hardware installation.
.3 Start-up and point calibration

.3 Coordinate EMCS schedule with construction schedule.

1.5 CONSTRUCTION PROGRESS MEETINGS

.1 Comply with requirements of Division 01.

1.6 SHOP DRAWINGS AND INFORMATION

.1 Comply with requirements of Division 01 and as follows:

.1 Within thirty (30) days of contract award, provide:

.1 CAD drawings of the proposed system architecture. Include the generators built in sensors.

.2 Point layouts of generator sensors as well as wiring diagrams for attached devices. Include Logical Point Mnemonics if applicable.

.3 Technical data sheets for all equipment and devices.

.2 Within sixty (60) days of contract award, provide:

.1 Control software descriptions, by module, explaining EMCS control sequences and logic. Include Logical Point Mnemonics for all virtual points as well as print out or code for each module.

1.7 PROJECT RECORD DOCUMENTS

.1 Comply with requirements of Division 01.

1.8 EMCS MANUALS, CATALOGUES AND BACK-UPS

.1 Operators' Manuals: Update existing Mechanical O&M Manuals EMCS controls section with new controls equipment and schematics where applicable.

1.9 QUALITY ASSURANCE

.1 Provide and install a fully proven system as described, including field tested hardware, operating system and applications software.

.2 Demonstrate capability to service system from service departments or organizations located within Alberta. Provide names, call out phone numbers and resumes for applicable service personnel.

1.10 CONTRACT ACCEPTANCE PROCEDURES

.1 Comply with requirements of Division 01.

.2 Prior to Interim Acceptance of the Work, complete all requirements of Section 25 08 95 – EMCS: Start-Up and Testing. Submit a copy of the completed point checkout sheets.

.3 Prior to Interim Acceptance of the Work, the installed system must be of acceptable quality by having:

.1 No new controls failures over the previous sixty (60) days of continuous operation.

.2 No significant unexplained failures (glitches) over the previous twenty (20) days of continuous operation.

1.11 WARRANTY

.1 Correct all defects in workmanship, material or software during the duration of the warrantee period.

.2 Correct all system failures occurring during warranty period.

Part 2 Products

2.1 TAGS, LABELS, NAMEPLATES AND DIRECTORIES

.1 Comply with the identification requirements of Section 25 09 28 – EMCS: Field Work.

Part 3 Execution

3.1 GENERAL

.1 The building is currently equipped with a Building Automation System. Mechanical contractor is to sub-contract "Automatic Controls" for this scope of work which is the original controls contractors.

3.2 IDENTIFICATION

.1 Comply with the identification requirements of Section 25 09 28 – EMCS: Field Work.

.2 Conduit Identification: apply paint or colour banding tape in required colours for each voltage or system in accordance with APWSS Colour Coding Requirements.

3.3 START-UP AND TESTING

.1 Start and test the EMCS system as specified in Section 25 08 95 – EMCS: Start-Up and Testing.

3.4 TRAINING OF OPERATORS

.1 Provide four (4) hours of training for one operator according. Schedule to be determined during construction.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 09 23 – EMCS: General Requirements and other related EMCS Sections.

1.2 REGULATORY REQUIREMENTS

.1 Comply with Electrical Protection Act of Alberta and rules and regulations made pursuant thereto, including the Canadian Electrical Code.

.2 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the edition of the Canadian Electrical Code, Part I, CSA C22.1, and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.

.3 All electrical products shall be approved by the Canadian Standards Association (CSA) and bear the CSA label. Alternatively, where a product does not bear a CSA label, it shall be approved in writing by the authority having jurisdiction.

.4 Submit to authority having jurisdiction and utility company, necessary number of drawings and specifications for examination and approval prior to commencement of work. Pay associated fees.

.5 Submit to Departmental Representative, copy of electrical permit obtained from authority having jurisdiction.

.6 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.

Part 2 Products

2.1 CONDUIT

.1 EMT: to CSA C22.2 No. 83-M1985. Provide rain-tight fittings in weatherproof and damp areas.

.2 Rigid Metal: to CSA C22.2 No. 45-M1981.

2.2 WIRE

.1 Wiring: to CSA C22.2 No. 75-M1983, copper conductor, 600 V RW90 X-link insulation. 300 V insulation allowed for conductors not entering enclosures containing line voltage.

.2 120 VAC Control Wiring: minimum #14 AWG.

.3 Low-Voltage Field Wiring:

.1 Minimum #22 AWG.

.2 Twisted pairs.

.3 Stranded, except #18 AWG and larger may be solid.

.4 Shielded with drain wire, except for digital input/output wiring carrying less than 25mA and not installed in tray.

.5 Multiconductor wiring must have individually twisted and shielded pairs with a drain wire for each pair. Cable must have overall shield. Maximum six (6) pairs.

.4 Plenum rated cable:

.1 FT4 rated.

.2 Refer to the CEC for other designations meeting FT4 criteria.

2.3 IDENTIFICATION MATERIALS

.1 Wiring Identification Materials:

.1 Use one of the following:

.1 Heat shrink sleeves, with thermally printed identifier. Label material and printing to be resistant to oil, mineral solvent and methyl alcohol.

.2 Snap-on or slide-on sleeves, or crimp-on pins with integral sleeve. Length to suit number of characters required in identification code, six (6) characters minimum. Marking elements to be removable yet secure when inserted into sleeve. Standard of quality: Grafoplast Wiremarkers Inc.

.3 Factory coded slip-on identification bead markers or sleeves.

.2 Size of sleeves to be selected so that they do not slip off when wire is removed from termination and shaken.

.3 Wrap-on adhesive strips not allowed. Hand written identifiers not allowed.

.2 Point Identification Tags: 0.75 mm thick plastic laminated luggage style tags containing imprinted information label. Printing on surface of plastic not allowed. Printing shall be 14 point font or larger.

.3 Engraved Plastic Nameplate: self-adhesive composite laminated plastic nameplates with one (1) smooth white surface and core of black plastic designed to leave black lettering on a white background.

Part 3 Execution

3.1 CONDUIT

.1 Use EMT conduit:

.1 For all high-speed communications trunk wiring between RCUs.

.2 For wiring that would be exposed to mechanical damage.

.3 For wiring in inaccessible areas.

.4 Where indicated on drawings or otherwise required by CEC.

.2 Use rigid metal conduit for all wiring in areas designated as hazardous.

.3 Conduit sizing and installation shall comply with CEC requirements. Wire fill shall not exceed 50%.

.4 Wherever practical, conceal conduit in walls, floors and ceilings.

.5 Install conduit parallel or at right angles to building lines; minimize crossovers and conserve space and headroom.

.6 Do not install conduit in or under ground floor slabs.

.7 Do not use metallic or non-metallic sheathed cable except where otherwise indicated.

3.2 WIRING

.1 Neatly arranged panduit with snap on covers shall be used to restrain wiring inside cabinets larger than 300mm square.

.2 Neatly train and cable tie wiring in cabinets smaller than 300 mm square. Adhesive backed twist ties or adhesive backed cable tie holders are not allowed. Wiring shall be secured to cabinet back with mountable cable ties fastened with #8 or larger sheet metal screws.

.3 Each field device shall have its own signal and return wire individually terminated in the panel. The use of a common return wire or ground for more than one control point is not allowed.

.4 A single continuous non-spliced cable shall be used for connecting each field device. Joining of cables is only permitted as follows:

.1 New points: Only one (1) splice for every 100 meters of cable.

.2 Existing points where the existing wire is allowed to be reused: Only if the final length of unspliced run exceeds 10 meters.

.3 The type of wire, gauge, colour and number of conductors to any device, shall remain the same right from the device through to the termination connectors in the control panel.

.4 Splices are only allowed within equipment cabinets or junction boxes. The shield drain wire for each pair must be connected. Splices shall expose no more than 2cm of unjacketed wire.

.5 Except as indicated next, only properly sized insulated spring wire connectors with plastic insulating caps or solderless pressure connectors with insulated covers by Marr, Ideal or 3M are allowed for splicing. The use of screw type terminal blocks is required for splicing ALL wiring entering a cabinet or junction box when any one of the following conditions exists:

.1 The panel or junction box contains more than ten (10) connections.

.2 Multi-conductor cables with more than four (4) wires are to be spliced.

.6 Terminal blocks must be screw mounted with #8 or larger sheet metal screws in panels or junction boxes no smaller than 150 mm square.

.5 The use of existing field wiring is permitted. The contractor is responsible for ensuring that any reused wire is suitable for the application and meets the requirements of this Section.

3.3 GROUNDING

.1 Provide a complete ground system for all EMCS equipment, including panels, conductors, conduit, raceways, connectors and accessories. Grounding shall be by means of electrical supply conductor bonding method. Separate grounding conductors not permitted.

.2 Grounding between control panels and field devices shall have a star configuration. The shield for a field device shall be grounded at the panel only.

3.4 IDENTIFICATION

.1 Conduit:

.1 Apply paint or colour banding tape in fluorescent orange for control wiring conduit in 35 mm wide bands all around conduit as follows:

.1 At least once in each 10 m of conduit run.

.2 Where conduit enters inaccessible ceiling, wall and floor spaces.

.3 At least once in each room or area through which a conduit passes.

.2 Applying fluorescent orange paint to all conduit fittings prior to installation is an acceptable practice. However, additional identification banding shall be added as required to meet all requirements of this article.

.2 Wiring:

.1 Wiring more than 1 meter in length must be labelled at both ends.

.2 Labels for all system point wiring shall, as a minimum, contain the following information:

.1 Panel end: panel terminal number or hardware address.

.2 Device end: panel number as well as panel terminal number or hardware address.

.3 Label panel power supply wiring with the panel connector number.

.4 Label communications port wiring with panel connector number and device name (e.g. "J1-modem", "J2-printer").

.5 Label communications trunk wiring with the panel number, router number etc. to which the other end of the cable is connected.

.6 Wiring on each side of a terminal block or splice shall be labelled with the information required for the device end of the wire.

.7 In retrofit situations the above labelling requirements are in addition to any existing labelling.

.3 Point Tagging:

.1 Identify all input sensors and devices as well as all EMCS controlled output actuators, motors and equipment, with Point Identification Tags. Provide multiple tags as necessary. Additional requirements as follows:

.1 Tag control wiring for major mechanical equipment at equipment terminal strip.

.2 Tag any input/output transducers not identified on an Equipment Cabinet Directory.

.3 Tag electric motors on power cable near motor end.

.2 Point Identification Tags shall be attached using two (2) nylon cable ties. One (1) tie is to provide a loose loop through the tag while the other tie is to hold this loop to the wire or conduit.

.3 All Point Identification Tags shall include the following minimum information:

.1 Logical Point Mnemonic (refer to Section 25 09 30).

.2 Associated System Identification.

.3 Point Description.

.4 Nameplates:

.1 Identify the following with engraved plastic nameplates:

.1 Magnetic contactors and related local disconnect switches.

.2 Space temperature sensors and intelligent thermostats.

.3 Front panel mounted switches, displays and devices; identify function of each item.

.2 Nameplates shall include logical point mnemonic as applicable. Refer to Section 25 09 30.

.3 All nameplates to be easily visible without need to use ladder or extraordinary body position. Affix additional nameplates if necessary.

.4 Provide the Departmental Representative with an example of the contents of each type of nameplate as indicated in 3.2.1 above. Obtain approval prior to engraving.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 09 23 – EMCS: General Requirements and other related EMCS Sections.

.2 The letters under the "Type" column in the following Schedule are the same used in Section 25 09 30 - Point Database Schedule and also on the drawings.

Part 2 Products

2.1 SENSING DEVICES

.1 Provide field instrumentation and sensing devices, analog or digital as applicable, which measure fluid level. and which input signals to the EMCS that conform to the input requirements.

.2 The end-to-end accuracy called for in the following Schedule includes the combined effect of all the errors in all the interposing devices and components between the measured variable and the value displayed at the Central Control Station.

2.2 ANALOG INPUT SENSORS – TEMPERATURE

Application	Type	Operating Range	End-to-End Accuracy	Remarks
Level Sensor	Ls	0m-20m	±0.1m	Replace existing sensor

Part 3 Execution

3.1 INSTALLATION

.1 All new level sensors in holding tanks and water tower, confirm locations of level sensors and availability of any existing sensor openings with Departmental Representative.

3.2 USE OF EXISTING DEVICES

.1 The use of existing devices is permitted.

.2 The Contractor is responsible for ensuring that any reused device is suitable for the application and meets the requirements of this Section.

.3 Every reused device must be tested for proper operation. All adjustable analogue devices shall be recalibrated for zero and span.

END OF SECTION

Part 1 General

1.1 INTENT

.1 Read this Section in conjunction with Section 25 09 23 – EMCS: General Requirements and other related EMCS Sections.

1.2 DEFINITIONS

.1 A point is a specific software address which is resident in the controllers and which is identified with a particular field sensor, instrument, relay or actuator.

.2 The point schedule contains a list and description of the points to be connected.

.3 The relationships between the points, systems and building are described in the control sequences, Section 25 09 93.

1.3 SCHEDULES

.1 Following is appended to and forms part of this Section:

.1 Energy Management Control System - Point Database Schedule.

Part 2 Products - Not Applicable

Part 3 Execution

3.1 POINT SCHEDULES

.1 Digital Inputs; refer to Section 25 09 29 - Digital Input Devices Schedule and input type designation in schedule.

.2 Digital Outputs; refer to Section 25 09 29 - Digital Output Devices Schedule and output type designation in schedule.

.3 Analog Inputs; refer to Section 25 09 29 - Analog Input Sensors Schedule and input type designation in schedule. Consult with minister's representative during the system start-up for limits and alarm values to be entered.

.4 Analog Outputs; refer to Section 25 09 29 - Analog Output Devices Schedule and output type designation in schedule.

.5 All points included under the same group letter must reside within the same panel. Any form of inter panel communications link to accomplish this is not allowed.

3.2 POINT SCHEDULE

.1 Provide sufficient points required to fulfill the sequence of operations as per Section 25 09 93 – EMCS: Control Sequence.

.2 As a minimum provide the following points:

Description	Input		Output		Note
	Digital	Analog	Digital	Analog	
EAST Storage Tank Level Sensor		X			Replace existing level sensor.
WEST Storage Tank Level Sensor		X			Replace existing level sensor.
Water Tower Tank Level Sensor (Refer to Note 1)		X			Replace existing level sensor.
Fire Pump Controller "P-13A" General Status	X				
Fire Pump Controller "P-13B" General Status	X				
Supervised Valve Position		X			
Supervised Valve Position		X			
Supervised Valve Position		X			
Supervised Valve Position		X			
Generator Enclosure Temperature Sensor		X			Coordinate with Generator Package Vendor
Generator Enclosure Fuel Level Sensor		X			Coordinate with Generator Package Vendor
Generator General Alarm	X				Coordinate with Generator Package Vendor
Generator Intrusion Detection	X				Coordinate with Generator Package Vendor
Existing Tower Feed Pump#1 Status		X			
Existing Tower Feed Pump#2 Status		X			
Existing Tower Water Control Valve		X			
Generator Building Low Ambient Temperature Alarm	X				Coordinate with Generator Package Vendor
Generator Low Fuel Level Alarm	X				Coordinate with Generator Package Vendor

NOTE 1:
Water level sensor on water tower will have to be installed on the outside surface of the water tower.

END OF SECTION

Part 1 **General - Not Applicable**

Part 2 **Products - Not Applicable**

Part 3 **Execution**

3.1 **GENERAL REQUIREMENTS**

.1 Provide the database for all physical points listed in the Point Schedule. Any physical points used in the sequences are shown in bold and capitalized.

.2 Provide the database for all virtual points identified in this section. Virtual points are shown in bold capitalized italic. Provide all necessary controllers, display screens, trend logs as well as any other item as may be required to create, test and modify the control strategies.

.3 Provide all programming required to implement the control sequences described in this section.

.4 Programming style is to be of a form that enables the control strategies to be easily followed. Clarity, simplicity and elegance are more important than program size.

.5 Programs shall be modular in nature and shall be as structured as the language will permit.

.1 Unconditional "GOTO" statements shall be used sparingly and shall always jump forwards. All jumps from the body of a module shall target the end of that module. Similarly, jumps from the body of a sub-module shall target the end of that sub-module.

.2 All conditional "GOTO" statements, which make a single choice from multiple choice sub-module options, shall form the opening lines of code of the module. Each succeeding conditional jump shall direct the execution of software to the relevant sub-module which shall be in the reverse order of the conditional jump statement. The exit from each sub-module shall jump to the end of the module.

.3 All conditional "GOTO" statements, for "AND"/"OR" choices between sub-modules, shall form the opening line of code in each sub-module which the conditional statement controls.

.6 All programs must include a sufficient number of comments to allow another person to make changes to the strategies at some later time.

.7 Additional programming may be provided by the Contractor as desired, so long as it does not affect the intended operation of the specified sequences. Ensure that all equipment will operate in a safe manner.

.8 Programming required for equipment safety may be installed by the Contractor as necessary. The Departmental Representative shall be notified of these changes as soon as practical.

.9 All deviations from the specified programming, except those related to equipment safety, must receive prior written approval from the Departmental Representative.

.10 All control loops shall be tuned such that they are stable through all seasons and operating conditions including startup.

.11 During the construction period through to the end of the warranty period, the Contractor shall be responsible for fine tuning the controls programming to ensure satisfactory operation. During this period the Contractor will also be responsible for any minor revisions requested by the Departmental Representative.

3.2 MISCELLANEOUS REQUIREMENTS

.1 Staggered starting - Motors must not be allowed to start at the same time. Under all conditions of start-up, return from power failure or panel reset, there must be at least a fifteen (15) second delay between the time one motor starts and another is allowed to start.

.2 Single phasing – If a phase monitor alarm contact has been provided in the main switch gear, provide routines to stop all 3-phase motors within sixty (60) seconds of contact activation.

3.3 SEQUENCE OF OPERATIONS

.1 Water Tower Fill Sequence of Operation:

.1 Existing sequence of operation and control panels to remain, contractor to replace sensors in East storage tank, West storage tank, and Water tower. Existing sequence is automated.

.1 Water Storage Tank (Existing sequence)

.1 Drumheller Institution has 2,140,000 gallons domestic water storage tanks, which are filled from an 8" city water line.

.2 Tanks have a common intake and discharge lines.

.3 Tanks are filled just below the overflow level which is around 17'. City valve is closed one level is reached by a float system within the holding tanks.

.4 City main pump off/on is controlled by a direct analog phone line from existing institutional controller to city main pump. Once tanks are depleted to around 75% capacity, floats send a signal to open our pneumatic valve, this sends a signal via phone line to start the city main pump, same when the tank is full to shut-off city pump.

.5 We also have the ability to manually override the start stop operation as this is needed by the city as the institution draws so much water it starves the rural areas that are on the same supply line.

.6 City also needs to draw water for various functions at the stampede barn and cannot do so while we are filling.

.2 Water Tower (Existing sequence)

.1 Drumheller institution has a 75,000 gallons water tower which stores domestic water to supply the institution with potable water.

.2 Tower is 134 ft. high which in turn supplies the domestic water pressure of around 58psi + elevation.

.3 As water is depleted from the tower, line pressure drops (54psi) activates 1 of the 2 tower pumps on, as well as a small stenner pump for chlorine injection, and water from the storage tanks is then pumped up the tower.

.4 If line pressure continues to drop to 53 psi (high usage) this triggers the second pump to also come on in order to keep up with the demand.

.5 Under normal conditions the tower pumps alternate in operation.

.6 Tower pumps also have a manual mode allowing operators to run on only one pump for pump servicing, etc.

.7 One level of 58 ft. is reached, tower pumps are triggered off.

.8 Existing control panel, the Type A has two (2) mercury switches and two independently adjustable timers. The first will time out after the start switch closes on a falling level to start the pump and the second will time out after the stop switch closes on rising level to stop the pump. Starting delay time can be entirely different from stopping delay time.

.9 Existing control panel, the Type C has two (2) mercury switches and a single timer which gives the same delay on start and stop. The timer will time out after the start switch closes to start the pump and when the top switch closes to stop the pump.

.2 This contractor shall be familiar with the operation of water tower controller so this contractor can set the controller up to fulfill the sequence of operations.

.3 Monitor the East storage tank water level, West storage tank water level, water tower water level and issue a warning at low levels.

.2 Generator:

.1 Generator Enclosure Temperature, issue warning on <10C.

.2 Generator Enclosure Fuel Level, indicate level.

.3 Generator Intrusion detection.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.6 Section 26 29 03 - Control Devices.

1.2 REFERENCES

.1 Definitions:

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

.2 CSA Group

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. (All related Standards, latest editions).

.3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit for review single line electrical diagrams under plexiglass and locate as indicated.

.1 Electrical distribution system in main electrical room.

.2 Electrical power generation and distribution systems in power plant rooms.

.4 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.

.5 Shop drawings:

.1 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 coordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.4 Submit number of copies in accordance with Section 01 33 00 - Submittal Procedures of 600 x 600 mm minimum size drawings and product data to inspection authorities.

.5 If changes are required, notify Departmental Representative of these changes before they are made.

.6 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from Authority Having Jurisdiction upon completion of Work to Departmental Representative.

.7 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

.8 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start-up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan & Waste Reduction Workplan] related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

Part 2 Products

2.1 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 and labels for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and coordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core, and mechanically attached with self-tapping screws.

.2 Sizes as follows:

Name Plate 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.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	**Auxiliary**
Up to 250 V	Yellow	
Up to 600 V	Yellow	Green
Up to 5 kV	Yellow	Blue
Up to 15 kV	Yellow	Red
Telephone	Green	
Other	Green	Blue
Communication Systems		
Fire Alarm	Red	
Emergency Voice	Red	Lue
Other Security Systems	Red	Yellow

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

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 installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do 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.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, plastic, or sheet metal, 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.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate switches on latch side of doors.

.1 Locate disconnect devices in mechanical rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles and data outlets:

.1 General: 300 mm.
.2 Above top of continuous baseboard heater: 200 mm.
.3 Above top of counters or counter splash backs: 175 mm.
.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

3.7 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, 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.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.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 as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.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.

3.9 SYSTEM START-UP

.1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 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.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.18(R2018), Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65-03(R2018), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.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)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Materials

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper, copper alloy, aluminum, or aluminum alloy sized to fit copper or aluminum conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 and NEMA to consist of:

.1 Connector body and stud clamp for stranded, round, copper or aluminum, conductors or bar.
.2 Clamp for stranded, copper conductors or bar.
.3 Clamp for stranded aluminum conductors or round aluminum bar.
.4 Stud clamp bolts.
.5 Bolts for copper conductors or bar.
.6 Bolts for aluminum conductors or bar.
.7 Sized for conductors, or bars as indicated.

.4 Clamps or connectors for armoured cable, TECK cable, aluminum sheathed cable, Mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

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 Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables 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. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.

.3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2 and NEMA.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 26 05 00 - Common Work Results for Electrical.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.5 Section 26 05 36 - Cable Trays for Electrical Systems.

.6 Section 26 05 20 - Wire and Box Connectors – (0-1000 V).

1.2 REFERENCES

.1 CSA International

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 CAN/CSA 22.2 No. 123 Type RC90 and Certified to ULC S139 “Tests for Fire Resistive Cables”, Outlet Boxes, Conduit Boxes and Fittings.

.3 CAN/CSA-C22.2 No.65-03(R2018), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.4 CAN/CSA-S139-12 Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables.

.5 ULC No. System 120 Electrical Circuit Integrity Systems (FHITC.120).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

1.3 NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA

1.4 PRODUCT DATA

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non-Jacketed.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conductors:

.1 Grounding conductor: copper.
.2 Circuit conductors: copper.

.3 Insulation:

.1 Ethylene propylene rubber EP.
.2 Cross-linked polyethylene XLPE.
.3 Rating: 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: flat and interlocking, galvanized steel or aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

.1 One-hole malleable iron, steel, aluminum, or zinc straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two (2) or more cables at centers in accordance with manufacturer's requirements.

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.3 2-HOUR FIRE RATED CABLES

.1 Products shall meet the definition of two (2) hour fire rated cable system as defined in CSA 22.2 No. 123, shall be Type RC90 and Certified to ULC S139 "Tests for Fire Resistive Cables".

.2 Two (2) hour Fire Rating per ULC S139 with hose stream, Horizontal & Vertical applications.

.3 RC90 per CSA 22.2 No. 123.

.4 Electrical Circuit Integrity System #120 (FHITC) – ULC Canada.

.5 Rated for wet location rating 90 degrees Celsius.

.6 Conductors: annealed copper, size as indicated.

.7 Insulation: Ceramifable silicon insulation to form compact homogeneous mass throughout entire length of cable.

.8 Multi-conductor jackets: Ceramifable silicon rubber bedding layer

.9 Impervious welded copper sheath suitable for equipment bonding per CEC rules 10-618 and 10-804.

.10 Overall jacket: A corrosion-resistant jacket provided over the copper sheath.

.11 Shall meets NFPA 130 for Transit and NFPA 502 for Tunnel applications.

.12 Connectors: CSA listed brass, stainless steel or nickel MC connector suitable for a corrugated copper sheath.

.13 Termination kits : field installed or factory installed where required and approved for MI cable when applied to MI cable.

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90

.3 Armour: interlocking type fabricated from galvanized steel or aluminum strip.

.4 Type: ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.

.5 Connectors: anti short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: cross linked polyethylene or ethylene propylene rubber type RA90 rated 600V.

.3 Sheath: aluminum applied to form continuous smooth or corrugated seamless sheath.

.4 Outer jacket: thermoplastic applied over sheath and to be compliant to applicable Building Code classification for this project

.5 Fastenings for aluminum sheathed cable:

.1 One-hole aluminum, malleable iron, or steel straps to secure surface cables 25 mm and smaller. Two-hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two (2) or more cables at centers in accordance with manufacturer's installation guidelines.

.3 Threaded rods: 6 mm diameter to support suspended channels.

2.6 CONTROL CABLES

.1 Type: LVT: two (2) soft annealed copper conductors, twisted where indicated on drawings, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: cotton braid, or thermoplastic jacket, and armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: solid or stranded annealed copper conductors sized as indicated LVT: two (2) soft annealed copper conductors, twisted where indicated on drawings, sized as indicated:

.1 Insulation: PVC, polyethylene.

.2 Shielding: when indicated on drawings or specified by manufacturer, overall group: braided with metallized tapes over each pair of conductors.

.3 Overall covering: PVC jackets and where exposed to mechanical damage, sheath of aluminum interlocked armour.

.3 Type: 600 V stranded annealed copper conductors, twisted where indicated on drawings, sizes as indicated:

.1 Insulation: PVC, polyethylene.

.2 Shielding: when indicated on drawings or specified by manufacturer, overall group: braided with metallized tapes over each pair of conductors.

.3 Overall covering: PVC jackets and where exposed to mechanical damage, sheath of aluminum interlocked armour.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors – (0-1000 V).

.3 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit and cable tray systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable securely supported by straps.

3.5 INSTALLATION OF 2-HOUR FIRE RATED CABLES

.1 Install cables in stainless steel trays where indicated on drawings.

.2 Install cables exposed, securely supported by stainless steel straps and hangers.

.3 Follow the Manufacturer's Instructions to assure a valid two (2) hour fire rating. These special installations procedures are necessary to qualify to ULC S139 (temperature = 1010°C, time = two (2) hours)

.4 Cable supports: All supports must be secured to an equally fire rated structure (concrete, steel, etc.) with clamps (fasteners) that are steel or have been fire test qualified (see FHITC 120). This excludes supports that are aluminum, die cast (zinc), plastics, etc.

.5 Support two (2) hour fire rated cables at 1.22m intervals (or distance specified by manufacturer which ever is less) and in accordance with manufacturer's installation guidelines.

.6 All supports must be secured to an equally fire-rated structure (concrete, steel, etc.) with clamps (fasteners) that are steel or have been fire test qualified.

.7 Galvanized metals may not come in contact with the cables.

.8 Make cable terminations by using manufacturers supplied accessories.

.9 Cable terminations: use CSA listed brass, stainless steel or nickel MC connectors suitable for a corrugated copper sheath in accordance with manufacturers installation guidelines.

.10 Where cables are routed in cast concrete or masonry, sleeve cables though PVC ducts as shown on drawings for entry and exit of cables.

.11 Do not splice cables unless indicated.

3.6 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.8 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit, under floor raceways, cable troughs, underground ducts or by direct burial as indicated on drawings.

.2 Ground control cable shield at one end or in accordance with manufacturer’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

.1 CSA Group

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates: obtain inspection certificate of compliance covering high voltage stress from inspection authority and Departmental Representative include it with as-built drawings and maintenance manuals.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper or Aluminum long barrel compression connectors to CSA C22.2 No. 65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 2, 3, or 4-way joint boxes dry location type in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

.4 2, 3, or 4-way junction boxes with respective pothead for 2, 3 or 4 conductor cables for X - linked polyethylene cable with aluminum sheath, and overall jacket in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

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 connectors and terminations installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No. 41.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 American National Standards Institute / Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International

.1 CSA Z32-09, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as required.

.3 Rod electrodes: galvanized steel, copper clad steel, or stainless steel 19 mm diameter by minimum 3 m long.

.4 Plate electrodes: galvanized, steel, iron, or copper, surface area 0.2 m^2, minimum 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.6 Insulated grounding conductors: green, copper conductors, size.

.7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.8 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 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

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 grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 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.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Install grounding resistance bank where required.

.11 Install zig-zag grounding transformer where required.

.12 Connect building structural steel and metal siding to ground.

.13 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.14 Ground secondary service pedestals.

3.3 MAINTENANCE HOLES

.1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each maintenance hole.

.2 Install ground rod in each maintenance hole 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.

3.4 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod, or plate electrodes and make grounding connections as indicated.

.5 Bond separate, multiple electrodes together.

.6 Use size in accordance with ATCO Electric, copper conductors for connections to electrodes.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.5 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 600 V system, coordinate installation with ATCO Electric.

3.6 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to 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, cable trays.

3.7 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.

.2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.8 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:

.1 Communications grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.9 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U-shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended, or set in poured concrete walls and ceilings.

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 hangers and supports installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T-bar ceilings. Ensure that T-bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron, or steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support two (2) or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two (2) or more conduits use channels at 1500mm on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 26 05 00- Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

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

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs and connection blocks to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat or turned edge covers.

2.3 CABINETS

.1 Construction: welded sheet steel or aluminum as indicated hinged door, handle, latch and catch

.2 Type E Empty: surface return flange or flush overlapping sides mounting as indicated.

.3 Type T Terminal: surface return flange or flush overlapping sides mounting as indicated containing 19 mm G1S fir plywood backboard.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating system name voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit samples for floor box in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one (1) conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster and tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass or brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 73 mm for receptacles and communication outlets.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.7 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 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of two (2) piece stainless steel or die-cast aluminum with brushed aluminum or satin aluminum housing finish for two (2) duplex receptacles. Bottom plate with two (2) knockouts for centered or off-set installation. 12 x 102 mm extension piece as indicated.

.2 Pedestal type 'low tension' fitting made of two (2) piece stainless steel or die cast aluminum with brushed aluminum or satin aluminum housing finish to accommodate two (2) amphenol jack connectors.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.40-M1989(R2009), Cut Out, Junction and Pull Boxes.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for raceway and boxes and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for raceway and boxes for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect raceway and boxes from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SPLICE BOXES

.1 Splice boxes cast iron enclosures 6 mm thick painted with chromate primer and grey enamel to provide mechanical protection and moisture seal for direct buried cable splices rated 0.6 kV and consisting of:

.1 Two (2) halves, split along cable axis, finely ground matching surfaces, fastened with silicon bronze or galvanized steel bolts, top half with large filling holes with gasketted plugs for medium hard asphalt base compound, bottom half with screws on inside for bonding armour, and box end openings sealed by:

.1 Wrapping cables with anhydrous tape and clamping to make snug fit, for 2, 3 and 4-way splices.

.2 boxes with cable entrance fittings suitable for interlocking armour sheaths, for 2, 3 and 4-way splices.

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 raceway and boxes installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install splice boxes at cable joint, on floor of trench. Tighten armour clamps and fill with compound.

.1 Ground splice boxes as required.

.2 Install junction boxes on trench floor around cable splice to CSA C22.2 No.40. Connect cable terminals to box contacts.

.1 Ground junction boxes as required.

.2 Fasten lid securely and check for air leaks before trench is backfilled.

.3 Install distribution level steel boxes on walls of maintenance holes. Splice main cable in box and connect branch feeder. Fasten cover and fill with compound.

.1 Ground steel boxes as required.

.4 Install power level boxes as follows:

.1 Cast iron type: on trench floor, connect cable terminals to box contacts, fasten lid and fill with compound before trench is backfilled.

.2 Steel type: mount on wall of maintenance holes; connect cables to box terminals; install disconnect links, fasten lid securely.

.3 Ground power level boxes as required.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.

.3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 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.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, hot dipped galvanized steel or aluminum threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, steel or aluminum liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

.1 One (1) hole malleable iron or steel straps to secure surface conduits 50 mm and smaller.

.2 Two (2) hole steel straps for conduits larger than 50 mm.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits at 1.5m on centre.

.5 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 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.

2.6 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use rigid galvanized steel, hot dipped galvanized steel, or aluminum threaded conduit where specified.

.4 Use electrical metallic tubing (EMT) except in cast concrete.

.5 Use rigid pvc conduit underground.

.6 Use flexible metal conduit for connection to motors in dry areas.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.8 Use explosion proof flexible connection for connection to explosion proof motors.

.9 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.10 Minimum conduit size for lighting and power circuits: 19 mm.

.11 Install EMT conduit from branch circuit panel to outlet boxes located in sub floor.

.12 Install EMT conduit from branch circuit panel to junction box in sub-floor immediately below panel.

.1 Run flexible conduit from junction box to outlet boxes in sub-floor.

.13 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.14 Mechanically bend steel conduit over 19 mm diameter.

.15 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.16 Install fish cord in empty conduits.

.17 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.18 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.19 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.2 Install in centre one third (1/3) of slab.

.3 Protect conduits from damage where they stub out of concrete.

.4 Install sleeves where conduits pass through slab or wall.

.5 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.6 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.7 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.8 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Embedded in sufficient concrete to provide minimum 100 mm of concrete from any surface of conduit to exterior of concrete encasement. Provide steel rebar cage to ensure integrity of concrete encasement.

.2 Slope conduits to provide drainage.

3.8 CONDUITS ROUTED TO FIRE PUMPS AND TO FIRE PUMP CONTROLLERS

.1 Embedded in sufficient concrete to provide minimum 100 mm of concrete from any surface of conduit to exterior of concrete encasement in order to provide two (2) hour fire rating. Provide steel rebar cage to ensure integrity of concrete encasement.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No. 126.1-09, Metal Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1-2017, Metal Cable Tray Systems.
.2 NEMA VE 2-2013, Cable Tray Installation Guidelines.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.4 Identify types of cabletroughs used.

.5 Show actual cabletrough installation details and suspension system.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 CABLETROUGH

.1 Cabletroughs and fittings: to CAN/CSA C22.1 No. 126.1-2.

.2 Ladder to CAN/CSA C22.2 No. 126.1-2.

.3 Trays: stainless steel, width as shown on drawings and depth as required to meet 60% fill or less.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.

.1 Radii on fittings to meet requirements of existing site conditions.

.5 Solid covers for complete cabletrough system including fittings.

.6 Barriers where different voltage systems are in same cabletrough.

.7 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.

.8 Provide fire stop material at firewall penetrations.

2.2 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cabletrough system in accordance with NEMA VE 2.

.2 Support cabletrough on both sides.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Lay cables into cabletrough. Use rollers when necessary to pull cables.

.3 Secure cables in cabletrough at 6 m centres, with nylon ties.

.4 Identify cables every 30 m with size 2 nameplates in accordance with Section 26 05 00 - Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.26-1952(R2009), Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wireways and auxiliary gutters and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wireways and auxiliary gutters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wireways and auxiliary gutters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22.2 No. 26.

.2 Sheet steel with hinged or bolted cover to give uninterrupted access.

.3 Finish: baked grey enamel in accordance with Section 26 05 00 - Common Work Results for Electrical.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

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 wireways and auxiliary gutters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install wireways and auxiliary gutters in accordance with manufacturer's written recommendations.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

.6 Ground metallic wireways and gutters as required.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 - Common Work Results for Electrical.

.2 Section 26 05 34 – Conduits, Conduit Fastenings & Conduit Fittings.

.3 Section 26 05 53 - Identification for Electrical Systems.

1.2 SCOPE

.1 This section describes materials and methods used in the provision of concrete- encased underground ducts, handholes, and precast concrete manholes.

.2 Refer to Section 26 05 34 – Conduits, Conduit Fastenings & Conduit Fittings, for product information and installation requirements for underground conduit.

1.3 COORDINATION

.1 Coordinate excavation and backfilling for trenches with work specified in Division 31.

.2 Coordinate installation of underground ducts and raceways in concrete with work specified in Division 03.

.3 Coordinate manhole elevations with final site elevations as indicated on Drawings.

1.4 SUBMITTALS

.1 Refer to Division 01 and Section 26 05 00 - Common Work Results for Electrical for general requirements pertaining to submittals and submittal procedures.

.2 Submittals shall be included in the Operation and Maintenance Manual, specified in Division 01 and Section 26 05 00.

.3 Shop Drawings:

.1 Provide manufacturer's literature including applicable reference standards, performance and test data for the following:

.1 Handholes and precast manholes.

.1 Indicate dimensions, weights, openings, etc.

.4 Photographs:

.1 Prior to work being concealed in underground concrete duct banks, provide photographs of installed conduit prior to concrete pour.

.1 Show securing method, duct depth, separation between conduits, etc.

.2 Include representative photograph for each straight run, and each bend, offset and transition. Provide additional photographs, where instructed by Consultant.

Part 2 Products

2.1 CABLE RACKS

.1 Construction: hot dipped galvanized steel.

2.2 MARKERS

.1 Concrete type cable markers:

.1 100 x 600 x 100 mm, with words "cable", "joint" or "conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

.2 Cedar post type markers:

.1 89 x 89 mm square, 1500 mm long, pressure treated with copper napthenate or 5% pentachlorophenol solution, water repellant preservative, with nameplate fastened neat post top, on side facing duct.

.2 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick, mounted on cedar post with mylar label 0.125 mm thick with words "cable", "joint", or "conduit" with arrows to indicate change in direction.

Part 3 Execution

3.1 GENERAL

.1 Install concrete encased underground duct banks, handholes, and precast manholes where indicated on the Drawings.

.2 Notify consultant so they may inspect underground ducts and be present during pouring of concrete and clean-out of conduit installed in underground duct banks.

.3 Identify systems and equipment as per Section 26 05 53 - Identification for Electrical Systems.

3.2 INSTALLATION OF CONCRETE ENCASED UNDERGROUND DUCT BANKS

.1 Prepare trenches for duct bank:

.1 Build duct bank on undisturbed soil.

.2 Construct "mud slab" not less than 75 mm thick prior to laying ducts.

.3 Install ducts with minimum slope of 1 to 400.

.4 Install base spacers at maximum intervals of 1500 mm, levelled to grades indicated for bottom layer of ducts.

.2 Install conduit in duct banks:

.1 Clean conduit before lying in duct bank. Cap ends of conduit during construction to prevent entrance of foreign materials.

.2 Maintain spacing between conduit at not less than 100 mm horizontally and vertically.

.3 Stagger joints in adjacent conduits at least 150 mm and make watertight.

.4 Make transpositions, offsets and changes in direction using 5 degree bend sections. Do not exceed a total of 20 degrees with duct offset.

.5 Use bell ends at conduit terminations in manholes or buildings.

.6 Use anchors, ties and trench jacks as required to secure conduit and prevent moving during pouring of concrete. Tie conduit to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.

.3 Encase duct bank with 100 mm thick concrete cover:

.1 Immediately after placing of concrete, pull through each conduit a wooden mandrel not less than 300 mm long and of a diameter 6 mm less than the internal diameter of conduit, followed by a stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely.

.2 Allow concrete to attain 50% of its specified strength before backfilling.

.4 Pull stiff bristle-brush through each conduit immediately before pulling in cables.

3.3 INSTALLATION OF MARKERS

.1 Mark locations of duct runs under hard surfaced areas not terminating in a manhole with railway spike driven flush in edge of pavement, directly over run.

.1 Place concrete duct marker at ends of such duct runs.

.2 Construct markers and install flush with grade.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Identification for electrical systems, equipment, conduit and related components.

1.2 REFERENCE STANDARDS

.1 Federal Standard 595C – Colours.

Part 2 Products

1.3 IDENTIFICATION MATERIALS

.1 Lamicoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:

.1 Size 1: 12 mm high with 5 mm high letters.
.2 Size 2: 20 mm high with 8 mm high letters.
.3 Size 3: 25 mm high with 12 mm high letters.

.2 Printed Labels: Self-adhesive, permanent labels, letter size as per Lamicoid.

.1 Standard of Acceptance: Brother "P-Touch".

.3 Wire Identification Materials: Use one of the following:

.1 Heat shrink sleeves, blank.
.2 Clear plastic tape wrap-on strips with white writing section.
.3 Wrap-on strips, pre-numbered.
.4 Slip-on identification bead markers or sleeves, blank or pre-numbered.

.4 Colour Banding Tape: 25 mm wide adhesive backed plastic tape, integrally coloured.

2. Execution

2.1 COLOUR IDENTIFICATION OF EQUIPMENT

.1 Electrical equipment shall be prefinished in coded colours designating voltage or system, as indicated.

.2 All switchgear, distribution centre, panel boards, motor control centre, motor starter cabinets, motor control cabinets, disconnect switches, contractor cabinets, relay cabinets, transformers, termination cabinets, splitter boxes, busduct, cable duct, etc., are to be colour coded as follows:

	Voltage	**Colour**
.1	High Voltage (in excess of 750 V):	Brown
.2	347/600 V:	Sand
.3	120/208 V:	Grey
.4	Emergency Standby Power:	Associated Voltage Colour
.5	Fire Alarm & Firephone:	Red
.6	Security/Intrusion/Surveillance:	Green
.7	Low Voltage Switching:	Black
.8	Annunciator Cabinets:	Black
.9	Data/Telephone Cabinets:	Blue
.10	Backboards:	Grey
.11	Television:	White
.12	Public Address/Intercom:	Purple

.3 All pull boxes, junction boxes, covers, and conduit banding shall be finished in the following colours:

	System	**Colour**
.1	>750 V:	Brown
.2	>750 V Emergency Standby:	Brown (covers marked "EM")
.3	347/600 V:	Sand
.4	347/600 V Emergency Standby:	Sand (covers marked "EM")
.5	277/480 V:	Bronze
.6	277/480 V Emergency Standby:	Bronze (covers marked "EM")
.7	120/208 V:	Grey
.8	120/208 V Emergency Standby:	Grey (covers marked "EM")
.9	Fire Alarm & Firephone:	Red
.10	Security/Intrusion/Surveillance:	Green
.11	Data/Telephone (VOIP):	Blue
.12	Public Address/Intercom:	Purple
.13	Sound Masking:	Orange
.14	Nurse Call:	Yellow
.15	Television:	White
.16	Low Voltage Switching:	Black (covers marked "EM")
.17	Low Voltage Switching Emergency Standby:	Black (covers marked "EM")

Note: All cover markings are to be in "Black" lettering with the exception of Low-Voltage Switching – Emergency Standby that is to be marked with "White" lettering.

.4 Where impracticable to obtain equipment prefinished in coded colours, equipment may be site painted in coded colours.

2.2 NAMEPLATE IDENTIFICATION OF EQUIPMENT

.1 Except where indicated elsewhere, identify equipment with lamicoid nameplates.

2.3 PANELBOARD DIRECTORIES

.1 Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory.

2.4 COMMUNICATIONS CABLE AND EQUIPMENT LABELLING

.1 Label communication outlets, panels and ports with lamicoid nameplates as specified in Equipment Identification Schedule.

.2 Label each of cables with other ends address using Wire Identification Materials.

.3 Label outlets with labels vertically aligned in each row.

.4 Position panel labels in the same position on each panel.

2.5 INTERMITTENT COLOUR CODING OF CONDUIT AND CABLE

.1 Apply colour banding (tape or paint) in required colours for each voltage or system in 25 mm wide bands all around conduit or cable as follows:

.1 At least once in each 10 m of conduit or cable run.
.2 Where conduit or cable enters inaccessible ceiling, wall and floor spaces.
.3 At least once in each room or area through which a conduit or cable passes.

.2 Apply colour banding on electrical conduit and cable in the following locations:

.1 Exposed in service areas.
.2 Exposed in unfinished areas.
.3 Semi-concealed spaces.
.4 Exposed to exterior.

2.6 IDENTIFICATION OF PULL AND JUNCTION BOXES

.1 Identify pull and junction boxes over 100 mm size as follows:

.1 Use boxes which are prefinished in coded colours, or spray paint inside and outside of boxes prior to installation, in coded colours designating voltage or system.

.2 Apply size 2 lamicoid nameplate to cover of each box. Identify system name. Where sequence identification is required, identify system name and number.

.2 Identify pull and junction boxes 100 mm or less in size as follows:

.1 Spray paint inside of boxes in coded colours designating voltage or system.

.2 Apply permanent identifying markings directly to box covers designating voltage or system using indelible black ink.

2.7 COLOUR IDENTIFICATION OF WIRING

.1 Identify No. 4/0 AWG wiring and smaller by continuous insulation colour.

.2 Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.

.3 Colour coding shall be in accordance with Canadian Electrical Code, and as follows:

	Voltage	Colour
.1	120/208V, 3 phase:	Red, black and blue
.2	120/208V standby:	Red, black and blue with yellow tracer
.3	347/600V 3 phase:	Orange, brown and yellow
.4	347/600V standby:	Orange, brown and yellow with red tracer

.4 Where multi-conductor cables are used, use same colour coding system for identification of wiring throughout each system.

.5 Maintain phase sequence and colour coding throughout each system.

2.8 NAME/NUMBER IDENTIFICATION OF WIRING

.1 Identify No. 8 AWG wiring and smaller using one of the wire identification materials specified in IDENTIFICATION MATERIALS.

.2 Type or print on blank wire identification materials using indelible black ink.

.3 Identify wiring at all pull boxes, junction boxes, and outlet boxes for all systems.

.4 Identify each conductor as to panel and circuit, terminal, terminal numbers, system number scheme, and polarization, as applicable.

2.9 IDENTIFICATION OF RECEPTACLES

.1 Provide lamicoid nametag with 6 mm high white lettering on black background (red background for emergency receptacles). Locate on wall above cover plate.

.1 Standard duplex receptacles: Indicate circuit and panel designation.

.2 Other receptacles: Indicate voltage, phase, amps, circuit and panel designation.

2.10 IDENTIFICATION OF FIRE ALARM END-OF-LINE RESISTORS AND DUCT DETECTORS

.1 Identify zone number with 6 mm high white lettering on red background on lamicoid nametag located on wall above device. Identify remote LED indicators for duct detectors.

2.11 IDENTIFICATION OF SWITCHES FOR HEALTH CARE FACILITIES

.1 Provide lamicoid nametag with 6 mm high white lettering on black background above all lighting and dimmer switches at patient bedside and nurses' stations.

.2 Nametag is to describe function of switch, such as "Exam Light", "General Lighting", etc. Three-position switches are to also indicate all positions, such as "High/Off/Low", "Night/Off/General", etc.

2.12 EQUIPMENT IDENTIFICATION SCHEDULE

Equipment	Colour	Nameplate Identification	Lamicoid Nameplate Size
Main Distribution Center	Voltage Colour	• Building name, consulting engineer, date installed, amperage, voltage	3
		• Main Breaker, Metering Cabinet	2
		• Instrument transformer enclosure	2
		• Loads controlled by each overcurrent protective device	1
		• Metering devices	1
Distribution Centers	Voltage Colour	• Distribution center designation, amperage, voltage	2
		• Loads controlled by each overcurrent protective device	1
Panelboards	Voltage Colour	• Panelboard designation	2
Motor Control Centres	Voltage Colour	• M.C.C. designation, amperage and voltage	2
		• Motors or loads controlled by each unit and mnemonics	1
		• Relay terminal and transformer compartments	1
Manual Motor Starters	N/A	• Load controlled	1
Ground Bus	N/A	• System Ground	1
On/Off Switches	N/A	• Load Controlled	1
Disconnect Switches, Magnetic Motor Starters and Contactors	Voltage Colour	• Voltage and equipment controlled	2
Transformers	Voltage Colour	• Transformer designation, capacity, secondary and primary voltages	2
Emergency Standby Power Equipment	Voltage Colour	• Designation and voltage	2

Equipment	Colour	Nameplate Identification	Lamicoid Nameplate Size
Wireways	N/A	• Voltage and system designation	2
Line Voltage Cabinets and Enclosures	Voltage Colour	• Designation and voltage	2
Low Voltage Cabinets and Enclosures	System Colour	• System name; system name and number if more than one cabinet or enclosure	2
		• Major components within cabinets and enclosures	1
Communication Outlet and Outlet Assemblies	N/A	• Outlet Designation	1
Communication Panels	N/A	• Panel Designation	1
Communication Ports	N/A	• Port Designation	1

2.13 COLOUR SCHEDULE

Electrical Colours	Federal Standard 595C Colour Numbers
Blue	15052
Green	14449
Brown	10115
Sand	12516
Grey	16307 or ASA61 Grey
Black	17038
Bronze	13275
Purple	17100
Orange	12473
Yellow	13655
Red	11350

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

.6 Section 26 29 02 - Fire Pump Control.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 100-04, Motors and Generators.

.2 CSA C22.2 No. 145-M1986(R2004), Motors and Generators for Use in Hazardous Locations.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC M1-7-1992, Standard for Motors and Generators.

.2 EEMAC M2-1-1966, Standard for Lead Marking and Connections for Single-Phase and Polyphase Induction Motors.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Indicate:

.1 Overall dimensions of motor.
.2 Shaft centreline to base dimension.
.3 Shaft extension diameter and keyway, coupling dimensions and details.
.4 Fixing support dimensions.

.5 Dimensioned position of ventilation openings. Details of ventilation duct attachments.
.6 Terminal box location and size of terminals.
.7 Arrangement and dimensions of accessories.
.8 Diagram of connections.
.9 Starting current and relative data necessary for use in design of motor starting equipment.
.10 Speed/torque characteristic.
.11 Weight.
.12 Installation data.

.4 Closeout Submittals:

.1 Provide maintenance data for motors for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Data necessary for maintenance of motors.

.3 Manufacturer's recommended list of spare parts.

.5 Quality Assurance:

.1 Departmental Representative reserves the right to witness standard factory testing of motors 50 hp, or 37.3 kW and above.

.2 Submit site tests results of installed electrical systems and instrumentation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Handle motors with suitable lifting equipment.

.3 Store motors in heated, dry, weather-protected enclosure.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect, package and store expired motors for either recycling or rebuilding and return to recycler or rebuilder.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials and spare parts in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Motors:

.1 Non-hazardous locations: to CSA C22.2 No. 100 and EEMAC M1-7.
.2 Hazardous locations: to CSA C22.2 No. 145.

.2 Lead markings: to EEMAC M2-1.

2.2 CORROSION PREVENTION AND FINISH PAINTING

.1 Provide equipment resistant to corrosion from severe moisture conditions.

2.3 RATING

.1 Motor:

.1 Operation: integral to fire pump package; controlled and driven by fire pump control system

2.4 MOTOR TYPE

.1 Squirrel cage induction.

2.5 DESIGN LETTERS

.1 Polyphase squirrel cage induction motors design A, B, C, or D.

.2 Single phase integral induction motors design L, or M.

2.6 ENCLOSURE

.1 Open drip proof fully guarded.

.2 Open guarded.

.3 Totally enclosed non-ventilated.

.4 Totally enclosed fan cooled.

.5 Totally enclosed pipe ventilated for use in non-hazardous location.

.6 Totally enclosed explosion proof for use in: hazardous location.

2.7 APPLICATION

.1 Motor suitable for driving pump.

2.8 PERFORMANCE CHARACTERISTICS

.1 Refer to fire pump package and coordinate electrical requirements.

2.9 LOCKED ROTOR KVA PER [HP] [KW]

.1 Locked rotor kVA per hp and nameplate.

2.10 DIRECTION OF ROTATION

.1 In accordance with fire pump manufacturer's data sheets.

2.11 BEARINGS

.1 Antifriction type bearings, fitted with readily accessible facilities for lubrication while motor running or stationary.

2.12 MOTOR MOUNTING AND TERMINAL HOUSING

.1 Vertical flange mounting to inline pump, refer to fire pump specifications and data sheets.

.2 Slide rails for motor mounting.

2.13 SHAFT

.1 Standard shaft extension.

2.14 THERMAL PROTECTION

.1 Factory installed for each phase, wired to identified terminals in motor terminal box in accordance with fire pump manufacturer's installation manuals.

2.15 STARTING METHOD

.1 Terminate winding connection necessary for appropriate starting method and identify in motor terminal box by referring to manufacturer's installation manuals.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Dry out motor if dampness present in accordance with manufacturer's instructions.

.2 Install motors in coordination with the General and Mechanical Contractors and in accordance with the manufacturer's installation manuals.

.3 Make wiring connections.

.1 Use liquid tight pvc jacketed flexible conduit between rigid conduit and motor.

.4 Make flexible conduit long enough to permit movement of motor over entire length of slide rails.

.5 Check for correct direction of rotation, with motor uncoupled from driven equipment.

.6 Align and couple motor to driven machinery to manufacturer's instructions, using only correct parts such as couplings, belts, sheaves, as provided by manufacturer.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 CSA International

.1 CSA C13-M83, Instrument Transformers.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for control and signal transformers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for control and signal transformers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect control and signal transformers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 POTENTIAL TRANSFORMERS

.1 Potential transformers: to CSA C13, dry type for indoor use.

.2 Potential transformers equipped with fuse holder and fuses. Fuses: as indicated.

2.2 CURRENT TRANSFORMERS

.1 Current transformers: to CSA C13, dry type for indoor use.

.2 Positive action automatic short-circuiting device in secondary terminals.

2.3 MOUNTING BRACKETS

.1 Potential transformers with suspension hooks for cross-arm mounting, channel type mounting brackets, or L type mounting brackets.

.2 Fabricate brackets and channels from electrogalvanized code gauge painted steel.

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 control and signal transformers installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install instrument transformers and ensure accessibility.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by control and signal transformers installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

.6 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and 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.

.2 600 V panelboards: bus and breakers rated for(symmetrical) interrupting capacity as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of two (2) flush locks for each panel board.

.6 Two (2) keys for each panelboard and key panelboards alike.

.7 Copper or Aluminum bus with neutral of same or double ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel or air-dried enamel as per colour schedule.

.11 Isolated ground bus.

.12 Include grounding busbar with three (3) terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for receptacles, fire alarm, and emergency circuits as required.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

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 panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Where panels of different systems (i.e. Standard and Vital Power) supply a common patient care area, ground busses in panels to be interconnect with a minimum #6 AWG ground conductor.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboard installations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non-Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsell System of Colour Notation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m^2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails 1.3 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

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 electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals

.5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55-M1986(R2008), Special Use Switches.

.4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect wiring devices from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SWITCHES

.1 15 and 20 A, 120 V and 347 V 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.

.3 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No. 42 with following features:

.1 Suitable for No. 10 AWG for back and side wiring.
.2 Break-off links for use as split receptacles.
.3 Eight (8) back wired entrances, four side wiring screws.
.4 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Suitable for No. 10 AWG for back and side wiring.
.2 Four (4) back wired entrances, two (2) side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Cover plates with thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal or Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one (1) manufacturer throughout project.

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 wiring devices installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 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 (1) switch is required in one (1) location.
- .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical or as indicated.

.2 Receptacles:

- .1 Install receptacles in gang type outlet box when more than one (1) receptacle is required in one (1) location.
- .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .4 Install GFI type receptacles as indicated.

.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.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 26 05 00 - Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide fuse performance data characteristics for each fuse type and size. Performance data to include: average melting time-current characteristics.

.3 Shop Drawings:

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

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location.

.4 Waste Management and Disposal:

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

1.4 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Three (3) spare fuses of each type and size installed above 600 A.

.3 Six (6) spare fuses of each type and size installed up to and including 600 A.

Part 2 Products

2.1 FUSES - GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for ten (10) seconds minimum.

.2 Type L2, fast acting.

.2 Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for ten (10) seconds minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for ten (10) seconds minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for ten (10) seconds minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class C fuses.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum, 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 - Common Work Results for Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install rejection clips for Class R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.5 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

.1 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-2010).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with ampacity of 400 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit number of copies in accordance with Section 01 33 00 - Submittal Procedures of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Departmental Representative.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store circuit breakers indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and ground-fault circuit-interrupters to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.6 Circuit breakers with interchangeable trips as indicated.

.7 Circuit breakers to have minimum symmetrical rms interrupting capacity rating in accordance with values shown on drawing.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded 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.

2.3 SOLID STATE TRIP BREAKERS [DESIGN D]

.1 Moulded 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 and instantaneous tripping for short circuit protection.

2.4 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.
.2 Auxiliary switch.
.3 Motor-operated mechanism.
.4 Under-voltage release.
.5 On-off locking device.
.6 Handle mechanism.

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 installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 26 05 00 - Common Work Results for Electrical.

.5 Section 26 28 13.01 - Fuses – Low-Voltage.

1.2 REFERENCES

.1 CSA Group

.1 CAN/CSA-C22.2 No.4-04(R2009), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).

.2 CSA C22.2 No.39-13, Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, Non-fusible and Horsepower rated disconnect switch in CSA enclosure, to CAN/CSA-C22.2 No. 4 size as indicated.

.2 Provision for padlocking in off switch position by three (3) locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses – Low-Voltage.

.5 Fuse holders: to CSA C22.2 No. 39 relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

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 disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

.6 Section 26 29 03 - Control Devices.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.14-13, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for contactors and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.

.3 Include operating information required for start-up, synchronizing and shut-down of generating units.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect contactors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held or Mechanically held controlled by pilot devices as indicated and rated for type of load controlled.

.3 Breaker or Fused switch combination contactor as indicated.

.4 Complete with two (2) normally open and two (2) normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA or NEMA Enclosure.

.6 Include following options in cover:

.1 Red and Green indicating lamps.
.2 Hand-Off-Auto selector switch.

.7 Control transformer: in accordance with Section 26 29 03 - Control Devices, factory wired and installed in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Size 4 nameplate indicating name of load controlled as indicated.

Part 3 Execution

3.1 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 Section 26 05 00 - Common Work Results for Electrical.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by contactor installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Division 21 - Fire Suppression.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No. 94.2-07, Enclosures for Electrical Equipment, Environmental Considerations.

.2 National Fire Protection Association (NFPA)

.1 NFPA 20-2010, Standard for the Installation of Stationary Fire Pumps for Fire Protection.

.3 Underwriters' Laboratories of Canada (ULC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fire pump controller and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Indicate:

.1 Overall dimensions.
.2 Fixing support dimensions, details.
.3 Schematic, wiring, interconnection diagrams.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for fire pump controller and accessories for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect fire pump controller from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 ELECTRIC MOTOR DRIVEN FIRE PUMP-CONTROLLER

.1 Main combined manual and automatic controller for squirrel cage induction motor-driven fire pump with integral automatic transfer switch between utility and generator power, variable speed and by-pass to auto-transformer reduced voltage starting, with emergency secondary by-pass to full voltage start. Accommodate in drip-proof CSA Enclosure, completely wired and tested by manufacturer before shipment from factory.

.2 To NFPA 20, and ULC listed for fire pump control.

.3 Rating: 100 hp, 600V, 3 phase, 60 Hz.

.4 Controller capable of being energized automatically through pressure switch or manually by externally operable handle.

.1 Pressure switch set to cut in according to Division 21 (Fire Suppression).

.2 Running period time set to keep motor in operation when started automatically, for minimum period of one (1) minute for each 10 hp of motor rating, but not to exceed seven (7) minutes.

.5 Pilot lamp to indicate circuit breaker closed and power available.

.6 Alarm relay to energize audible and visible alarm through independent source of power to indicate circuit breaker open or power failure.

.7 Alarm and signal devices in controller and in remote location to indicate trouble on controller and pumping unit, and loss of power.

.8 Ammeter test link and voltmeter test studs.

.9 Manual selector station, two (2) positions, marked "Automatic" and "Non-Automatic".

.10 Means on controller to operate alarm signal continuously while pump is running.

.11 Mark "FIRE PUMP CONTROLLER" in accordance with Section 23 05 43 – Identification for Mechanical Systems.

.1 Where multiple pumps are provided, indicate area or zone served by each pump controller.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.14-13, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000(R2015), Industrial Control and Systems: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for control devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Include schematic, wiring, interconnection diagrams.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan & Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes that were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.

.3 Regional Materials: submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for control devices for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect control devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No. 14 and NEMA ICS 1.

.2 Convertible contact type: contacts field convertible from NO to NC, electrically held, with solid state timer. Number of poles, coil and contact ratings in accordance with the application.

.3 Sealed contact type: electrically held with number of poles, coil and contact ratings in accordance with the application.

.4 Universal pole type: electrically held, convertible from NO to NC by changing wiring connections. Coil and Contact ratings in accordance with the application

.5 Fixed contact plug-in type: general purpose low coil current heavy duty. Coil and Contact ratings in accordance with the application.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 SOLID STATE TIMING RELAYS

.1 Construction: AC or DC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.

.2 Operation: on-delay or off-delay.

.3 Potentiometer: to provide time interval adjustment.

.4 Supply voltage and frequency: as required to suit the application.

.5 Temperature range: minus 20 degrees C to plus 60 degrees C.

.6 Output contact rating: maximum voltage 300 V AC or DC. Current: NEMA ICS 1.

.7 Timing ranges: minimum 0.5s, maximum 60 s.

2.4 INSTANTANEOUS TRIP CURRENT RELAYS

.1 Enclosure: CSA Type 1

.2 Contacts: NO, NC automatic reset with adjustable tripping point.

.3 Control: 3 wire, with provision for shorting contacts during accelerating period of motor.

.4 Contact rating: NEMA ICS 1 and to suit application.

2.5 OPERATOR CONTROL STATIONS

.1 Enclosure: CSA Type 4, surface or flush mounting:

2.6 PUSHBUTTONS

.1 Illuminated, Heavy duty. Operator as required for the application. Colour, number of contacts, voltage and VA ratings in accordance with the application.

2.7 SELECTOR SWITCHES

.1 Heavy duty. Operator as required for the application. Colour, number of contacts, voltage and VA ratings in accordance with the application.

2.8 INDICATING LIGHTS

.1 Heavy duty. Operator as required for the application. Colour, number of contacts, voltage and VA ratings in accordance with the application.

2.9 CONTROL AND RELAY PANELS

.1 CSA Type 1 sheet steel enclosure with hinged pad lockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.10 CONTROL CIRCUIT TRANSFORMERS

.1 Rated for continuous operation and in accordance to suit the application.

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 control devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 In accordance with manufacturer’s requirements and to meet operational intent.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.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.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC)

.1 IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Provide shop drawings for each type of starter to indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout and components.
.4 Enclosure types.
.5 Wiring diagram.
.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

.3 Extra Materials:

.1 Provide listed spare parts for each different size and type of starter.

.1 Three (3) contacts, stationary.
.2 Three (3) contacts, movable.
.3 One (1) contacts, auxiliary.
.4 One (1) control transformer.
.5 One (1) operating coil.
.6 Two (2) fuses.
.7 Ten (10%) percent indicating lamp bulbs used.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Starters: to IEC 947-4 with AC4 utilization category.

2.2 MANUAL MOTOR STARTERS

.1 Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 Three (3) overload heaters, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle, heavy duty labelled as indicated.

.2 Indicating light: heavy duty type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of 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.

.2 Combination type starters to include circuit breaker with operating lever on outside of enclosure to circuit breaker, and provision for:

.1 Locking in "OFF" position with up to three (3) padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Selector switches: heavy duty labelled as indicated.

.2 Indicating lights: heavy duty type and colour as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 FULL VOLTAGE REVERSING MAGNETIC STARTERS

.1 Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Two (2) - 3 pole magnetic contactors mounted on common base.
.2 Mechanical and electrical interlocks to prevent both contactors from operating at same time.
.3 Three (3) overload relays with heater elements, automatic reset.

.2 Accessories:

.1 Pushbuttons & Selector switches: heavy duty labelled as indicated.
.2 Indicating lights: heavy duty type and colour as indicated.
.3 Auxiliary control devices as indicated.

2.5 MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER

.1 Auto-transformer starter closed circuit transition will be part of fire pump control system. Type, of size, type, rating and enclosure type as well as accessories shall be defined by the fire pump controller vendor, refer to fire pump controller installation and operating manuals.

2.6 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.7 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight as required.

.2 Selector switches: heavy duty, oil tight as required.

.3 Indicating lights: heavy duty, oil tight, type and colour 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 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size engraved as indicated.

Part 3 Execution

3.1 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.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and manufacturer's instructions.

.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.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements

.3 Section 01 74 11 - Cleaning

.4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.5 Section 01 78 00 - Closeout Submittals.

.6 Section 26 05 00 - Common Work Results for Electrical.

.7 Section 26 36 23 Automatic Transfer Switches.

1.2 REFERENCES

.1 American Petroleum Institute (API)

.1 API Std. 650-2007(A2008), Welded Steel Tanks for Oil Storage 11th Edition.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-3.6-2000, Amend. 2, Regular Sulphur Diesel Fuel.

.3 Canadian Environmental Protection Act (CEPA)

.1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.

.4 CSA International

.1 CSA-B139-09, Installation Code for Oil Burning Equipment.

.5 International Organization for Standardization (ISO)

.1 ISO 3046-1-2002, Reciprocating Internal Combustion Engines - Performance - Part 1: Declarations of Power, Fuel and Lubricating Oil Consumptions, and Test Methods - Additional requirements for engines for general use.

.6 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1-2006(R2007), Motors and Generators.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S601-07, Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids.

.2 ULC-S603-00, Standard for Steel Underground Tanks for Flammable and Combustible Liquids.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets for power generators and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings and include:

.1 Engine: make and model, with performance curves.

.2 Alternator: make and model.

.3 Voltage regulator: make, model and type.

.4 Automatic transfer switch: make, model and type.

.5 Manual bypass switch: make and model.

.6 Battery: make, type and capacity.

.7 Battery charger: make, type and model.

.8 Alternator control panel: make and type of meters and controls.

.9 Governor type and model.

.10 Automatic engine room ventilation system.

.11 Cooling air requirements in m^3/s.

.12 British standard or DIN rating of engine.

.13 Flow diagrams for:

.1 Diesel fuel.

.2 Cooling air.

.14 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, and total weight.

.15 Continuous full load output of set at 0.8 PF lagging.

.16 Description of set operation including:

.1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.

.2 Manual starting.

.3 Automatic shut down and alarm on:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.6 Alternator over voltage.

.7 Lube oil high temperature.

.8 Over temperature on alternator.

.4 Manual remote emergency stop.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Packaging Waste Management: remove for reuse and return packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 2 fuel filter replacement elements.

.2 2 lube oil filter replacement elements.

.3 2 air cleaner filter elements.

.4 2 sets of fuses for control panel.

.5 Special tools for unit servicing.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Generating system consists of:

- .1 Diesel engine.
- .2 Alternator.
- .3 Alternator control panel.
- .4 Automatic transfer equipment.
- .5 Battery charger and battery.
- .6 Automatic engine room ventilation system.
- .7 Fuel supply system.
- .8 Exhaust system.
- .9 Steel mounting base.
- .10 Synchronizing panel.
- .11 Manual by-pass switch.

.2 System designed to operate as emergency standby unattended.

2.2 DIESEL ENGINE

.1 Diesel engine: to ISO 3046-1.

.2 Turbo charged, synchronous speed 1800 rpm.

.3 Capacity:

- .1 Rated continuous power in kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.
  - .1 Under following site conditions:
    - .1 Altitude: 700m.
    - .2 Ambient temperature: 20 degrees C.
- .2 Engine overload capability 110% of continuous output of prime rating for 1 hour within 12 hours period of continuous operation.

.4 Cooling System:

- .1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side, with ethylene glycol anti-freeze non-sludging above -46 degrees C.
- .2 Air cooled: air cooling duct enveloping cylinder walls with pressure cooling by engine driven blower.
- .3 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 degrees C.
- .4 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in ambient -30 degrees C.

.1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.

.5 Fuel: to CAN/CGSB-3.6, Type A, Arctic Grade 1.

.6 Fuel system: solid injection, mechanical fuel transfer pump, fuel filters and air cleaner, fuel rack solenoid energized when engine running.

.7 Governor: mechanical hydraulic with:

.1 Steady state speed band of plus or minus 0.5%.

.2 Speed regulation no load to full load 5% maximum.

.3 Electronic load sharing type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of plus or minus 0.25%.

.8 Lubrication system:

.1 Pressure lubricated by engine driven pump.

.2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.

.3 Lube oil cooler.

.4 Engine sump drain valve.

.5 Oil level dip-stick.

.9 Starting system:

.1 Positive shift, gear engaging starter 12 or 24V dc.

.2 Cranking limiter to provide three (3) cranking periods of 10s duration, each separated by 5 s rest.

.3 Lead acid, 12 or 24V storage battery with sufficient capacity to crank engine for 1 min at 0 degrees C without using more than 25% of ampere hour capacity.

.4 Battery charger : constant voltage, solid state, two stage from trickle charge at standby to boost charge after use.

.1 Regulation: plus or minus 1% output for plus or minus 10% input variation.

.2 Automatic boost for 6 hours every 30 days.

.3 Equipped with dc voltmeter, dc ammeter and on-off switch.

.4 Minimum charger capacity: 7 A.

.10 Vibration isolated engine instrument panel with:

.1 Lube oil pressure gauge.

.2 Lube oil temperature gauge.

.3 Lube oil level gauge.

.4 Coolant temperature gauge.

.5 Coolant level gauge.

.6 Running time meter: non-tamper type.

.11 Guards to protect personnel from hot and moving parts.

.1 Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

.12 Drip tray.

2.3 ALTERNATOR

.1 Alternator: to NEMA MG1.

.2 Rating: 3 phase, 600V, 4 wire, 600kW, 60 Hz, at 0.8 PF.

.3 Output at 40 degrees C ambient:

.1 100% full load continuously.

.2 110% full load for 1 hour.

.3 150% full load for 1 minute.

.4 Revolving field, brushless, single bearing.

.5 Drip proof.

.6 Amortisseur windings.

.7 Synchronous type.

.8 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.9 Exciter: permanent magnet.

.10 NEMA class F insulation on windings.

.11 Thermistors embedded in stator winding and connected to alternator control circuitry.

.12 Voltage regulator: thyristor controlled rectifiers with phase controlled sensing circuit.

.13 Alternator: capable of sustaining 300% rated current for period not less than 10 s permitting selective tripping of down line protective devices when short circuit occurs.

2.4 CONTROL PANEL

.1 Totally enclosed, free standing mounting base isolated from diesel generator.

.2 Instruments:

.1 Digital 100% solid state circuitry indicating type 2% accuracy, rectangular face, flush panel mounting:

.1 Voltmeter.

.2 Ammeter.

.3 Wattmeter scale 0 to 600 kW.

.4 Frequency meter: scale 55 to 65Hz.

.5 kVAR meter, kW.h meter.

.2 Voltmeter selector switch or toggle button, panel mounting, four position, labelled "Off-Phase A-Phase B-Phase C".

.3 Ammeter selector switch or toggle button, maintained contacts, panel mounting, designed to prevent opening of current circuits, four position labelled "OFF-Phase A-Phase B-Phase C".

.4 Instrument Transformers

.1 Potential-dry type for indoor use:
  .1 Ratio: 600 to 120.
  .2 Rating: 600V, 60Hz.
.2 Current-dry type for indoor use:
  .1 Ratio: 600 to 5.
  .2 Rating: 600V, 60Hz.
  .3 Positive action automatic short-circuiting device in secondary terminals.

2.5 CONTROLS

.1 Engine start button.

.2 Selector switch: Off-Auto-Manual - Test full load test no load.

.3 Engine emergency stop button and provision for remote emergency stop button.

.1 Alternator output breaker:
  .1 Two (2) circuit breakers as per single line diagram: bolt-on, moulded case, temperature compensated for 40 degrees C ambient, dual thermal-magnetic trip.
.2 Voltage control rheostat: mounted on inside of control panel.
.3 Operating lights, panel mounted:
  .1 "Normal power" pilot light.
  .2 "Emergency power" pilot light.
  .3 Green pilot lights for breaker on and red pilot lights for breaker off.
.4 Solid state indicator lights for alarm with 4 sets of manually reset NO/NC contacts wired to terminal block for remote annunciation on:
  .1 Low fuel level.
  .2 Low battery voltage.
  .3 Ventilation failure.
  .4 Low coolant temperature.
.5 Solid state controller for automatic shutdown and alarms with eight (8) sets of manually reset NO/NC contacts wired to terminal block for remote annunciation on:
  .1 Engine overcrank.
  .2 Engine overspeed.
  .3 Engine high temperature.
  .4 Engine low lube oil pressure.
  .5 Short circuit.
  .6 AC over voltage.
  .7 Minimum two (2) spare contacts.
.6 Lamp test button.
.7 Synchronization and load sharing.
.8 Provision for remote monitoring.

2.6 AUTOMATIC TRANSFER SWITCH

.1 Refer to Section 26 36 23 Automatic Transfer Switches.

2.7 MANUAL BYPASS SWITCH

.1 Load break bypass and isolation switch: manually operated, double throw, to provide bypass around transfer switch to facilitate maintenance on diesel generator control panel and transfer switch. Switch lockable in bypass position.

.2 By-pass shall be provided for both emergency and normal sources.

.3 Refer to Section 26 36 23 Automatic Transfer Switches.

2.8 STEEL MOUNTING BASE

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.

.1 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.3 Sound insulation pads for installation between isolators and concrete base.

2.9 EXHAUST SYSTEM

.1 Heavy duty industrial mounted exhaust silencer with condensate drain, plug and flanged couplings.

.2 Heavy duty flexible exhaust pipe with flanged couplings as required.

.3 Fittings and accessories as required.

.4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.

2.10 FUEL SYSTEM

.1 Fuel storage tanks: to API Standard 650, ULC labelled.

.1 Above ground tank: to ULC-S601.

.2 Underground tank: to ULC-S603.

.2 Belly type fuel storage tank: 24 hour rating, installed beneath generator mounting base stand with fill and vent lines to exterior of building.

.3 Fuel level gauge and vent alarm.

.4 Remote fueling level warning indicator light to be installed on generator building for fuelling from exterior of building.

.5 Drain and end plug.

.6 Black iron feed and return lines, with flexible terminations at engine.

.7 Shut-off cock.

.8 Renewable cartridge filter.

.9 Fire valve.

.10 Isolating valves on lines serving auxiliaries.

.11 Low fuel level alarm for remote indication.

2.11 COOLING AIR SYSTEM

.1 Engine ventilating system:

.1 Recirculating damper assembly with modulating motor.

.2 Cold air inlet damper assembly with modulating motor.

.3 Air discharge and intake gooseneck weatherhoods to be installed on exterior of generator building.

.4 Modulating thermostat.

.5 Replaceable air intake filters.

2.12 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Control panel:

.1 Size 5 nameplates for controls including alternator breakers and program selector switch.

.2 Size 3 nameplates for meters, alarms, indicating lights and minor controls.

2.13 FABRICATION

.1 Shop assemble generating unit including:

.1 Base.

.2 Engine and radiator.

.3 Alternator.

.4 Control panel.

.5 Battery and charger.

.6 Automatic transfer equipment.

2.14 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Alternator control cubicle: paint inside, exterior to match engine and alternator.

.3 Exhaust and inlet air hoods international orange.

.4 Other ducts and racks grey.

.5 Supply 0.25 L of grey touch-up enamel.

2.15 SOURCE QUALITY CONTROL

.1 Factory test generator set including engine, alternator, control panels, transfer switch and accessories in presence of Departmental Representative.

.2 Notify Departmental Representative days in advance of date of factory test.

.3 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data and at top of first sheet record:

.1 Date.

.2 Generator set serial no.

.3 Engine, make, model, serial no.

.4 Alternator, make, model, serial no.

.5 Voltage regulator, make and model.

.6 Rating of generator set, kW, kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.3 Departmental Representative's signature on completed forms to indicate concurrence in results of test.

.4 Tests:

.1 With 100% rated load, operate set for 24 hours, taking readings at 30 minutes intervals, and record following:

.1 Time of reading.

.2 Running time.

.3 Ambient temp in degrees C.

.4 Lube oil pressure in kPa.

.5 Lube oil temp in degrees C.

.6 Engine coolant temp in degrees C.

.7 Exhaust stack temp in degrees C.

.8 Alternator voltage: phase 1, 2, 3.

.9 Alternator current: phase 1, 2, 3.

.10 Power in kW.

.11 Frequency in Hz.

.12 Power Factor.

.13 Battery charger current in A.

.14 Battery voltage.

.15 Alternator cooling air outlet temp.

.2 At end of 24 hours run increase load to 110% rated value, and take readings every 15 minutes for 1 hour.

.3 After completion of 24 hours run, demonstrate following shut down devices and alarms:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.6 Alternator over voltage.

.7 Low battery voltage, or no battery charge.

.8 Manual remote emergency stop.

.9 High alternator temperature.

.4 Next install continuous strip chart recorders to record frequency and voltage variations during load switching procedures. Each load change delayed until steady state conditions exist. Switching increments to include:

.1 No load to full load to no load.

.2 No load to 70% load to no load.

.3 No load to 20% load to no load.

.4 20% load to 40% load to no load.

.5 40% load to 60% load to no load.

.6 60% load to 80% load to no load.

.5 Demonstrate:

.1 Automatic starting of set and automatic transfer of load on failure of normal power.

.2 Operation of manual bypass switch.

.3 Automatic shut down of engine on resumption of normal power.

.4 That battery charger reverts to high rate charge after cranking.

.6 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

Part 3 Execution

3.1 INSTALLATION

.1 Locate generating unit and install as indicated.

.2 Install fuel supply system as indicated in CSA-B139.

.3 Install ventilating air duct system as indicated.

.4 Pipe muffler drains to nearest floor drain.

.5 Complete wiring and interconnections as indicated.

.6 Start generating set and test to ensure correct performance of components.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Notify Departmental Representative 10 working days in advance of test date.

.3 Provide fuel for testing and leave full tanks on acceptance.

.4 Demonstrate:

.1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.

.2 Unit start and shut down on "Manual" control

.3 Unit start and transfer on "Test" control.

.4 Unit start on "Engine start" control.

.5 Operation of manual bypass switch.

.6 Operation of automatic alarms and shut down devices.

.5 Run unit on load for minimum period of 4 hours to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

.6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Divert unused batteries from landfill to battery recycling facility approved by Departmental Representative.

.3 Divert unused lubricating oil materials from landfill to oil recycling facility approved by Departmental Representative.

.4 Divert unused antifreeze from landfill to antifreeze recycling facility approved by Departmental Representative.

.5 Waste Management: separate waste materials for reuse & recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.4 MAINTENANCE - CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA-B139.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 – Cleaning.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 79 00 - Demonstration and Training.

.5 Section 26 32 13.01 Power Generation Diesel.

.6 Appendix A: Generator Package for CSC Drumheller Institution CHP Fire Pump Replacement

1.2 REFERENCES

.1 CSA International

.1 CSA B139-09, Installation Code for Oil-Burning Equipment.

.2 CSA C282-09, Emergency Electrical Power Supply for Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for generating equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit verification of diesel engine & electric technicians' qualifications.

.4 Submit commissioning report.

1.4 QUALIFICATIONS

.1 Generator Supplier shall have minimum 10 years experience with installation of generator systems in and construction of modular, skid mounted buildings (packages) housing generator systems as well as installation and commissioning of those generator skid packages at sites in Alberta.

.2 Generator Supplier shall include qualifications as part of overall bid document submittal to demonstrates the required experience described in requirement 1.4.1.

.3 Use qualified mechanical & electric technicians.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Include materials as follows:

- .1 Conduits and boxes as required.
- .2 Copper fuel lines and fittings as required.
- .3 Primary fuel filter/water separator.
- .4 Insulation for exhaust system.
- .5 Electrical components as indicated.
- .6 Wiring material.
- .7 Antifreeze, propylene glycol.
- .8 Diesel fuel; participate in storage tank initial fill, plus top-up after testing.
- .9 As part of Manual Transfer Switch, wiring and materials, including necessary steel conduits and fittings for making connections.
- .10 The power circuit cables will be RW90 (-40 degrees C) cross link polyethylene.
- .11 The control circuit cables will not be less than No. 14, RW90, copper conductors, colour or number coded.
- .12 Electronic governor control cable shall be minimum size No. 18 stranded copper conductor, shielded complete with drain wire and overall PVC jacket.
- .13 Battery cable shall be welding cable type, extra flexible, rope stranded copper conductor with neoprene oil-resistant insulation, sized to limit voltage drop to 5% at time of peak load.

2.2 INSULATION

.1 Removable fibreglass jacket insulation rated for 650 degrees C minimum with stainless lacing hooks and wires.

- .1 Enclose jacket on inside by stainless steel mesh with outside cover silicone coated or aluminized fibreglass cloth: to USCG approved Non-Combustible Materials No. 164.009.

.2 Calcium Silicate removable insulation rated for 650 degrees C with exterior stainless steel protective cover and fastenings.

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 generating equipment installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate. Inform Consultant of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 LOCATING AND MOUNTING

.1 Locate unit within the Generator Package (AKA Generator Building or Skid Package) as indicated by Generator Package Vendor drawings.

.2 Fit and adjust isolators in accordance with manufacturer's installation and adjustment instruction bulletin contained in unit manual.

.3 Do not bolt housings to foundation if isolator housing feet are equipped with 6 mm rubber sound pads.

3.3 ALIGNMENT CHECK

.1 Since Engine-generator shaft alignment is adjusted at factory, check to ensure that no change has occurred due to shipment and handling.

.2 Where engine and generator housings are close coupled and instruments at hand are not suitable for measuring alignment within confines of housings, just loosen engine and generator hold down bolts and ensure that each foot is carrying proportionate amount of weight and feet are level on base plate.

3.4 FUEL SUPPLY SYSTEM

.1 Install fuel tank to CSA B139.

.2 Inspect thoroughly fuel tank and lines to confirm they are clean and free of foreign material before connecting fuel system.

.3 Install primary fuel filter/water separator and servicing shut-off valves as per Generator Package Vendor’s design. Provide 3 spare filter elements.

.4 Install ULC automatic fire shut-off valve. Locate upstream of any combustible fuel system component.

.5 Install vents, regulator and isolations valves.

.6 Install supply and return fuel lines between fuel tank and generator. Install flexible sections between the engine and fixed end of fuel lines from fuel tank, if required.

.7 Neatly install fuel lines parallel or perpendicular to building lines with no kinks or dents.

.8 Test fuel lines and report results to Departmental Representative and Inspector. Entirely replace fuel lines that may fail.

3.5 BATTERIES AND CHARGER

.1 For dry charged batteries, activate in accordance with manufacturer's instructions manual prior to installation.

.2 For wet batteries, inspect individually each battery cell and check electrolyte level.

.1 Check charge condition by measuring temperature and specific gravity of electrolyte.

.2 Consult manufacturer's instructions for recommended readings.

.3 If readings are lower, give batteries freshening charge until readings are reached.

.3 Locate batteries as indicated and ensure batteries are accessible for service.

.1 Run and protect cables to starting motor using cables supplied with unit.

.4 Install battery charger on wall, adjacent to batteries and make connection to batteries. Route circuit from Solar Power system panel to battery charger.

.5 Clean connections and tighten securely.

.6 Install removable plexiglass cover on batteries.

3.6 EXHAUST SYSTEM

.1 Install exhaust pipe and silencer using material supplied with unit. Arrange silencer above and approximately in line with engine exhaust manifold with exhaust tail pipe protruding through thimble in wall.

.2 Extend tail pipe 1 metre minimum beyond outside wall.

.3 Support silencer with hangers so no weight or stress is applied to engine exhaust manifold or turbocharger.

.4 Install flexible exhaust pipe between silencer and manifold.

.5 Install exhaust system fireproof insulating material, after test run.

.6 Route exhaust system in accordance with Generator Package design, ensuring exhaust tail pipe is installed in accordance with Code requirements and at an adequate distance from building openings.

3.7 COOLING AND VENTILATION

.1 Install Generator Package air outlet and inlet automatic dampers (and controls) interior metal ducting and snow hoods in their respective building openings.

.2 Install damper motors and linkages, adjust to ensure dampers are tight in closed position and give free damper movements from fully closed to fully open.

.3 Where canvas boot is not provided, maintain 13 mm clearance between radiator and air outlet duct.

.4 Mount thermostat within building in strategic position, away from inlet damper.

.5 Install conduits and junction boxes and make connections from damper actuator motors to thermostat and to 120/24 V AC transformer.

.6 Fill engine radiator with water/ethylene glycol antifreeze mix good for -40 degrees C.

.7 Install remote radiator including piping, valves, fittings and pumps as indicated.

3.8 CONTROL AND TRANSFER PANELS

.1 Locate panels as instructed by Generator Package Vendor in accordance with their design.

.2 Make control and power circuit connections as indicated. Identify cables at both ends.

.3 Tag with slip-on wire maker, each wire end with number corresponding to number in panel.

.4 Make terminations with self-insulated terminals of flanged fork or ring type.

3.9 ADDITIONAL WORKS

.1 Complete any additional work as instructed by Departmental Representative to:

.1 Ensure equipment is safe to operate.

.2 Provide complete and operating system.

3.10 FIELD QUALITY CONTROL

.1 Qualified diesel engine and electric technicians to: inspect and verify that installation of interruptible power unit is acceptable and complete. Provide inspection report to the Departmental Representative.

.2 Commissioning: do site commissioning of diesel electric generator unit by qualified diesel engine and electric technicians in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.

.3 Develop and submit commissioning report including time delay settings, operational set points and adjustment ranges.

3.11 SYSTEM STARTUP

.1 Preparation: before starting unit, carry out thorough mechanical and electrical inspection of equipment, and perform following checks and adjustments:

.1 Disconnect battery cables from batteries to prevent accidental starting.

.2 Turn engine several revolutions by means of hand-barring devices to ensure parts are free and there are no obstructions to its running.

.3 Check engine/generator alignment readings to ensure they match readings attained at time of manufacture. Check fluid levels and top up as necessary. Pre-lubricate engine and turbochargers as recommended by engine manufacturer. Install drip pan beneath engine.

.4 Confirm cooling system antifreeze is effective to at least minus 40 degrees C.

.5 Check belts for correct tension and adjust as necessary.

.6 Check and grease points.

.7 Check and tighten properly nuts, bolts.

.8 Confirm safety guards are in place and properly secured.

.9 Check linkages for damage and freedom of movement.

.10 Check fuel supply system for leakage.

.11 Ensure fuel supply and fuel injection systems are properly primed.

.12 Check and tighten properly electrical connections.

.13 Check starting battery electrolyte level specific gravity and for proper installation.

.14 Check battery charger for proper operation and adjust as necessary.

.15 Carry out generator winding insulation resistance test. If reading is unacceptable, carry out recognized drying procedure. Do not start unit until satisfactory reading has been achieved.

.16 Check jacket coolant heater for proper operation.

.17 Complete additional preparations deemed necessary.

.2 Performance verification: on completion of start-up preparations, take following action:

.1 Have at hand, during initial start-up, means for choking off air supply to engine air induction manifold in event of engine run away or other emergency.

.2 Reconnect starting battery cables to starting battery.

.3 Start unit only in presence of the Departmental Representative and allow to warm up. Stop unit if abnormal conditions are encountered.

.4 Check for and correct leakage from exhaust system, fuel system, cooling system, and lubricating oil system.

.5 Adjust vibration isolators.

.6 Observe and confirm lubricating oil pressure and coolant temperature are within limits and no harmful vibration or sounds are evident.

.7 Ensure voltage is within operating parameters and automatic voltage regulator is operating correctly.

.8 Ensure manual voltage control is operating correctly.

.9 Ensure frequency is within operating parameters and electronic governor is operating correctly.

.10 Check engine air ventilation system for proper operation.

.11 Check operation of engine-mounted protective sensing devices and adjust as necessary.

.12 Check phase sequence of normal power supply and ensure emergency power supply are in same sequence.

.13 Check operation of electronic controller protection, transfer, timing, metering, and annunciator functions and adjust as necessary.

.14 Check operation and calibration of analog metering and adjust as necessary.

.15 Apply electrical load, read the metres, and correlate these readings.

.16 Demonstrate:

.1 SOURCE 1, transfer to OFF position, unit shutdown, transfer to SOURCE 2.

.2 Unit cranking, start, and shutdown by means of engine-mounted key switch.

.3 With doors closed, at Generator Package Vendor's construction site, supply load bank and run unit on full (nameplate) load for minimum period of 4 hours to show load-carrying capability, stability of voltage and frequency, and satisfactory performance of engine ventilating system and building damper system to provide adequate cooling, exhaust system.

.4 Every 1/2 hour carry out and record readings on Test Chart.

.17 Perform additional tests as required by Departmental Representative and Inspector to confirm unit is operating satisfactorily.

3.12 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.13 DEMONSTRATION AND TRAINING

.1 As directed by Consultant and in accordance with Section 01 79 00 - Demonstration and Training carry out demonstrations of complete interruptible power unit for Project Acceptance Board. Deliver familiarization training of operating and maintenance staff.

.1 Include instruction to site operation and maintenance staff for proper care, operation, and maintenance of equipment.

.2 Maintain services for such period, and for as many visits as necessary to put equipment in operation, and confirm that operating personnel are conversant with aspects of its care and operation.

.2 Include fuel required for performing diesel-generator site test and top-up after acceptance test completion.

3.14 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect fuel lines from mechanical damage.

.3 Repair damage to adjacent materials caused by electric power generating equipment installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

.4 Section 01 78 00 - Closeout Submittals

.5 Section 26 05 00 - Common Work Results for Electrical

.6 Section 26 28 16.02 – Moulded Case Circuit Breakers

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.5-16, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, NMX-J-266-ANCE-2010).

.2 CSA C22.2 No.178.1-2014, Automatic Transfer Switches.

.3 CAN/CSA C60044-1-07(R2011), Instrument Transformers.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 2-1996(R2009), Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC, Part 8: Disconnect Devices for Use in Industrial Control Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for transfer switches and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Make, model and type.

.2 Load classifications

.3 Single line diagram showing controls and relays.

.4 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.

.2 Test control.

.3 Manual control.

.4 Automatic shutdown.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes were recycled or salvaged.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for transfer switches for incorporation into manual.

.3 Detailed instructions to permit effective operation, maintenance and repair.

.4 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect transfer switches from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below pre-set adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

2.2 MATERIALS

.1 Instrument transformers: to CAN/CSA C60044-1.

.2 Contactors: to NEMA ICS2.

2.3 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

.1 Circuit Breaker Type Transfer Equipment: to CSA C22.2 No.5.

.2 Rated: 600 V, 60Hz, 400A, 4 wire,.

.1 Fault withstand rating: 42 kA symmetrical for 3 cycles.

.2 One (1) normal-3 pole moulded-case circuit breaker with thermal magnetic, mounted on common base, designed for double throw action, motor operated, mechanically held and interlocked, CSA enclosure floor mounted.

.3 One (1) emergency -3 pole moulded-case circuit breaker with thermal magnetic trip, motor operated, and interlocked.

.4 Circuit breakers:

.1 Trip free in closed position.
.2 Interrupting rating: 65kA symmetrical.

.5 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.

.6 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.

.7 Solid neutral bar, rated: 400 A.

.8 Overlapping switchable neutral pole on circuit breaker type equipment.

2.4 CONTROLS

.1 Selector switch 4 position "Test", "Auto", "Manual", "Engine start".

.1 Test position - normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.

.2 Auto position - normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.3 Manual position - transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.

.4 Engine start position - engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.2 Control transformers: dry type with 120 V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

.1 Voltage sensing: 3 phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2 V minimum undervoltage and over voltage protection.

.2 Time delay: normal power to standby, adjustable solid state, five (5) seconds to twenty (20) minutes.

.3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 0 to 60 s delay.

.4 Time delay on retransfer from standby to normal power, adjustable five (5) seconds to ten (10) minutes.

.5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state twenty (20) second intervals to twenty (20) minutes.

.6 Time delay during transfer to stop transfer action in neutral position to prevent fast transfer, adjustable, five (5) second intervals to one hundred eighty (180) seconds.

.7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches pre-set adjustable values.

.8 Neutral disconnected position delay: allow time for motors to delay between live sources, adjustable, zero (0) to five (5) seconds.

.4 Solid state electronic in-phase monitor.

2.5 ACCESSORIES

.1 Ensure pilot lights indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.

.2 Plant exerciser: one hundred sixty-eight (168) hours timer to start standby unit once each week for selected interval transfers load to emergency supply and retransfers to normal supply on standby unit shutdown. Timer adjustable zero to one hundred sixty-eight (0-168) hours in fifteen (15) minute intervals.

.3 Auxiliary relay to provide minimum eight (8) N.O. and minimum eight (8) N.C. contacts for remote alarms.

.4 Instruments:

.1 Digital true RMS, indicating type 2 % accuracy, flush panel mounting:

.1 Voltmeter
.2 Ammeter.
.3 Frequency meter: scale 55 to 65 Hz.

.5 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labelled "OFF-Phase A-Phase B-Phase C".

.6 Potential transformers - dry type for indoor use:

.1 Ratio: 600 to 120.
.2 Rating: 600, 60Hz,

.7 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, four (4) position labelled "OFF - Phase A - Phase B - Phase C".

.8 Current transformers - dry type for indoor use:

.1 Ratio: 500 to 5.
.2 Rating: 600 V, 60Hz,
.3 Positive action automatic short- circuiting device in secondary terminals.

.9 Manual bypass and isolator: to both supplies.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Control panel:

.1 For selector switch and manual switch: size 5 nameplates.

.2 For meters, indicating lights, minor controls: use size 3 nameplates.

.3 Nameplates.

2.7 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Departmental Representative.

.2 Notify Departmental Representative days minimum in advance of date of factory test.

.3 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

.4 In-phase monitor operation.

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 transfer switches installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate, install and connect transfer equipment as indicated.

.2 Check relays, solid state monitors and adjust as required to ensure correct operation.

.3 Install and connect battery, remote alarms.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Manual" position and check to ensure proper performance.

.5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for ten (10) minutes, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.7 Repeat, at one (1) hour intervals, 4 times, complete test with selector switch in each position, for each test.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 47 17 - Sustainable Requirements.

.3 Section 01 74 11 – Cleaning.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 Government of Canada

.1 TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire Protection Electronic Data Processing Equipment.

.2 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524-2001, Standard for the Installation of Fire Alarm Systems.

.2 CAN/ULC-S525-1999, Audible Signal Device for Fire Alarm Systems.

.3 CAN/ULC-S526-2002, Visual Signal Devices for Fire Alarm Systems.

.4 CAN/ULC-S527-1999, Control Units.

.5 CAN/ULC-S528-1991, Manual Pull Stations for Fire Alarm Systems.

.6 CAN/ULC-S529-2002, Smoke Detectors for Fire Alarm Systems.

.7 CAN/ULC-S530-M1991, Heat Actuated Fire Detectors for Fire Alarm Systems.

.8 CAN/ULC-S531-2002, Standard for Smoke Alarms.

.9 CAN/ULC-S536-S537-2004, Burglar and Fire Alarm Systems and Components.

.4 National Fire Protection Agency

.1 NFPA 72-2002, National Fire Alarm Code.

.2 NFPA 90A-2002, Installation of Air Conditioning and Ventilating Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include:

.1 Layout of equipment.
.2 Zoning.
.3 Complete wiring diagram, including schematics of modules.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

.4 Closeout Submittals:

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.

.2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.

.3 Submit to Authority of Jurisdiction two (2) sets of approved submittals and drawings immediately after approval but no later than fifteen (15) working days to prior to final inspection.

.4 Submit following:

.1 Manufacturer's Data for:

.1 Control panel and modules.
.2 Storage batteries.
.3 Battery charger.
.4 Manual pull stations.
.5 Heat detectors.
.6 Open-area smoke detectors.
.7 Duct smoke detectors.
.8 Alarm bells.
.9 Alarm horns.
.10 Visible appliances.
.11 Main annunciator.
.12 Remote annunciator panel.
.13 Graphic annunciator panel.
.14 Master fire alarm boxes.
.15 Auxiliary transmitter.
.16 Master box pedestal.
.17 Radio master box pedestal.
.18 Master box.
.19 Radio master box location light.
.20 Radio fire alarm master box.
.21 Radio fire alarm auxiliary transmitter.
.22 Radio fire alarm interface panel.
.23 Combination auxiliary transmitter and interface panel.
.24 Freeze protection thermostatic switch.
.25 Electro-magnetic door holder-releases.
.26 Valve tamper switches.
.27 Wiring.
.28 Ground rods.
.29 Conduit.
.30 Outlet boxes.
.31 Fittings for conduit and outlet boxes.
.32 Trouble buzzer.
.33 Projected beam smoke detector.
.34 Surge suppression devices.
.35 Mark data which describe more than one type of item to indicate which type will be provided.
.36 Submit one (1) original for each item and clear, legible, first-generation photocopies for remainder of specified copies.

.2 System wiring diagrams:

.1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.

.2 Show modules, relays, switches and lamps in control panel.

.3 Design data: Power Calculations:

.1 Submit design calculations for existing system plus new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.

.2 Show comparison of detector power requirements per zone versus control panel smoke detector power output per zone in both standby and alarm modes.

.3 Show comparison of notification appliance circuit alarm power requirements with rated circuit power output.

.4 Instructions for operation:

.1 Fire alarm system shall monitor all existing loops, new signals from two (2) fire pumps, fire pump & suppression system auxiliary devices and devices and signals from the new 600kW generator building. Refer to drawings for additional information.

.2 The Central Heating Plant fire alarm system shall communicate all information to the Drumheller Institution's central monitoring facility (PIDS). A new communications link shown on the drawings shall provide the physical connection between the two buildings.

.5 Schedules:

.1 Conductor wire marker schedule.

.6 Test Reports:

.1 Fire pump test reports shall be included in fire alarm testing documentation.

.2 Fire Alarm vendor reports shall be submitted to the Departmental Representative prior to final sign off and issuance of fire alarm verification certificate.

.3 Preliminary testing:

.1 Final acceptance testing.

.2 Submit for inspections and tests.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in fire alarm system installations approved by manufacturer with minimum five (5) experience and licenced (provide licence number) by the Canadian Fire Alarm Association (CFAA).

.2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

.3 System:

.1 To TB OSH Chapter 3-04.
.2 Subject to Fire Commissioner of Canada (FC) approval.
.3 Subject to FC inspection for final acceptance.
.4 To Canadian Forces Fire Marshal approval.

.4 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.5 Maintenance Service:

.1 Provide one (1) year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to CAN/ULC-S525.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Addressable Modules: to CAN/ULC-S527.

.7 Manual pull stations: to CAN/ULC-S528.

.8 Thermal detectors: to CAN/ULC-S530.

.9 Smoke detectors: to CAN/ULC-S529.

.10 Smoke alarms: to CAN/ULC-S531.

2.2 SYSTEM OPERATION

.1 Fire alarm panel shall match existing base fire alarm system located at PIDS building.

.2 Provide complete, electrically supervised, addressable, manual and automatic, zoned, annunciated, fire alarm system.

.3 Tie in existing monitoring loops (circuits) to tie-in point on fire alarm panel OR provide new addressable modules. If addressable modules are opted, they shall be installed above new fire alarm panel for integrating addressable loops into fire alarm panel. Supply one panel tie-in point or addressable module per existing conventional loop.

.4 Provide separate circuits from control panel to each existing loop (zone) of initiating devices.

.5 Single stage operation. Initiate system following:

.1 Manual stations (via conventional loops).
.2 Heat detectors (via conventional loops)
.3 Smoke detectors (via conventional loops).
.4 Existing pre-action system (via comm link).
.5 Automatic fire sprinkler system (flow).
.6 Either fire pump control panel (2) (new addressable devices)
.7 Fire standpipe system.
.8 Fire alarm panel receives signal from PIDS head-end.

.6 Actuation of single operation device to initiate following:

.1 Building evacuation alarm devices to operate continuously.

.2 Transmit signal to fire department via the Drumheller Institution's monitoring station.

.3 Zone of alarm device to be indicated on control panel.

.4 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.

.5 Fire doors and smoke control doors if normally held open, to close automatically.

.6 Electro-magnetic door holders to de-energize.

.7 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.

.7 Capability to program smoke detector status change confirmation on any or zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

.1 Class A.

.2 Single stage operation.

.3 Addressable

.4 Zoned.

.5 Non-Coded.

.6 Enclosure:

.1 CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and two (2) keys.

.2 Provide modular type panel installed in surface mounted steel cabinet with hinged door and cylinder lock.

.3 Mount with panel centerline 1.5 m above finished floor elevation.

.4 Switches and other controls: not accessible without use of key.

.5 Design of control panel: neat, compact assembly containing parts and equipment required to provide specified operating and supervisory functions of system.

.6 Control panel components: CSA approved and approved by control panel manufacturer for use in control panel.

.7 Panel cabinet: finished on inside and outside with factory-applied enamel finish.

.8 Provide main annunciator located on exterior of cabinet door or visible through cabinet door.

.9 Provide audible trouble signal.

.10 Provide permanent engraved identification plates attached to rear face of panel viewing window, for lamps and switches.

.11 Provide one (1) set of Form C dry alarm contacts per zone, common system Form C dry alarm contact, and common system Form C dry trouble contact.

.12 Permanently label switches.

.13 Provide panel with following switches:

.1 Trouble silencing switch which silences audible trouble signals without extinguishing trouble indicating lamp(s).

.1 For non-self-resetting type switch: Upon correction of trouble condition, audible signals will again sound until switch is returned to its normal position.

.2 For silencing switch of momentary action self-resetting type: trouble signal circuit automatically restored to normal upon correction of trouble condition.

.2 Evacuation alarm silencing switch which when activated will silence alarm notification appliances without resetting panel, and cause operation of system trouble signals. Subsequent alarm(s) from additional zone(s) not originally in alarm to cause activation of notification appliances even with alarm silencing switch in "silenced" position.

.3 Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of system and zone trouble signals.

.4 Reset switch which when activated will restore the system to normal standby status after cause of alarm has been corrected, and activated initiating devices reset.

.1 Operation of reset switch to restore activated smoke detectors to normal standby status.

.5 Lamp test switch.

.6 Drill switch which will enable test of notification appliances and restoration to normal without tripping master box.

.7 Master box disconnect switch which when activated will disconnect coded device and cause operation of system trouble signal.

.8 HVAC shutdown bypass switch. Operation of the switch to allow HVAC system to operate with detectors in alarm and cause operation of system trouble signals.

.7 Supervised, modular design with plug-in modules for expandability:

.1 Alarm receiver with trouble and alarm indications provision for remote supervised annunciation, for class A initiating circuit.

.2 Spare zones: compatible with smoke detectors and open circuit devices.

.3 Space for future modules.

.4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.

.8 Components:

.1 Coded alarm receiver panel with trouble and alarm indications for class A initiating circuit.

.2 Single stage alarm panels:

.1 Match existing system located in PIDS.

.3 Audible signal control with control circuits complete with terminals for wiring and plug-in modules for dc signals up to ampacity equal to existing device count plus two (2) interior and one (1) exterior annunciating devices on the new generator building. Panel shall provide trouble indication for class B connections.

.4 Common control and power units:

.1 Control panel containing following indications and controls:

.1 Panel shall work with existing circuits and existing head-end in PIDS
.2 "Power on" LED (green) to monitor primary source of power to system.
.3 "Power trouble" indication.
.4 "Ground trouble" indication.
.5 "Remote annunciator trouble" indication.
.6 "System trouble" indication.
.7 "System trouble" buzzer and silence switch c/w trouble resound feature.
.8 System reset switch.
.9 "Test" switch if applicable.
.10 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.
.11 "Signals silenced" indication.

.2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.

.3 Site-wide communication connections:

.1 Plug-in module capable of communication to head end in PIDS.

.2 Bypass switch c/w indicator for trouble at panel.

.5 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit.

.1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.

.2 Contact terminal size: capable of accepting 22-12 AWG wire.

2.4 POWER SUPPLY

.1 120 V, ac, 60 Hz input, 24 V dc output from rectifier to operate alarm and signal circuits, with standby power of gell cell batteries minimum expected life of four (4) years, sized in accordance with NBC.

2.5 MANUAL ALARM STATIONS

.1 Two (2) types: 1) Existing on existing loops and 2) suitable number of new devices in generator building.

2.6 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors: Two (2) types: 1) Existing, on existing conventional loops, 2) addressable, fixed temperature, located in generator building

.2 Open-Area Smoke Detectors: Two (2) types: 1) Existing, on existing conventional loops, 2) addressable, located in generator building.

2.7 ALARM INITIATING DEVICE SPACING AND LOCATION

.1 Two (2) types: 1) Existing bells, 2) audible/visual devices on new generator building

2.8 AUDIBLE SIGNAL DEVICES

.1 Two (2) types: 1) Existing, 2) audible/visual devices on new generator building.

2.9 END-OF-LINE DEVICES

.1 Two (2) types: 1) Existing on existing loops, 2) New devices required for new loops. End-of-line devices to control supervisory current in alarm circuits sized to ensure correct supervisory current for each circuit. Open short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.10 VALVE TAMPER SWITCHES

.1 Provide switches to monitor open position of valves controlling water supply to sprinkler systems.

.2 Switch contacts to transfer from normal position to off-normal position during first two revolutions of hand wheel or when stem of valve has moved not more than one-fifth of distance from its normal position.

.3 Provide switch with tamper resistant cover.

.4 Removal of the cover to cause switch to operate into off-normal position.

2.11 FLOW SWITCHES

.1 Provide switches to monitor flow of water supply to sprinkler systems.

.2 Switch contacts to transfer from normal position to off-normal position during flow of water, adjustable to duration of time water flows.

.3 Provide switch with tamper resistant cover.

.4 Removal of the cover to cause switch to operate into off-normal position.

2.12 FIRE PUMP RUN STATUS

.1 Provide programmable contacts in fire alarm panel to monitor when fire pump run signal is received from either fire pump (quantity 2).

2.13 OFF-PREMISES FIRE ALARM

.1 Provide Communication loop to base fire alarm system located in PIDS in accordance head-end fire alarm vendor requirements. Ensure system provides 2-way communication for signals and remote messages are reporting correct end device information.

.2 Fire alarm panel shall match existing base fire alarm system located at PIDS building.

2.14 GROUNDING

.1 Ground by connection from grounding terminal connection of box to either driven ground rod or buried, metallic water pipe.

.1 Resistance to ground: not exceed 10 ohms.

2.15 CONDUIT

.1 Rigid Steel Conduit:

.1 Zinc-Coated.

.2 Intermediate Metal Conduit (IMC):

.1 Zinc-coated steel only.

.3 Electrical Metallic Tubing (EMT).

.4 Surface Metal Raceway and Fittings:

.1 Two-piece painted steel.
.2 Totally enclosed snap-cover type.

2.16 WIRING

.1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.

.2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor

.3 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor.

.4 Wire for connection to base telegraphic alarm loop: No. 12 AWG minimum solid copper conductor.

.5 Insulation 75 degrees C minimum with nylon jacket.

.6 Colour code wiring.

2.17 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: on black lamicoid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

2.18 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524.

.2 Install main control panel and connect to ac power supply, dc standby power.

.3 Locate and install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits to main control panel.

.6 Locate and existing signalling circuits and tie in to new fire alarm panel.

.7 Connect signalling circuits to main control panel.

.8 Inspect condition of end-of-line devices at end of alarm and signalling circuits.

.9 Install remote annunciator panels and connect to annunciator circuit wiring.

.10 Locate and install door releasing devices.

.11 Locate and install remote relay units to control fan shut down.

.12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.13 Connect fire suppression systems to control panel.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal smoke, sprinkler system transmit alarm to control panel and actuate general alarm and ancillary devices operate.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Class A circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 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 as described in PART 1 - SUBMITTALS.

.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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.3 Verification requirements shall include:

.1 Materials and resources.
.2 Storage and collection of recyclables.
.3 Construction waste management.
.4 Resource reuse.
.5 Recycled content.
.6 Local/regional materials.
.7 Low-emitting materials.

3.4 TRAINING

.1 Arrange and pay for one (1) eight (8) hour day, with suitable breaks, of on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDE

.1 Materials and installation for chain link fences and gates.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29.06 - Health and Safety Requirements.

.3 Section 03 30 00 – Cast-in-Place Concrete.

.4 Section 26 05 28 - Grounding - Secondary.

1.3 MEASUREMENT PROCEDURES

.1 Measure supply and erection of chain link fence in metres erected including gates.

.2 Measure supply and erection of chain link fence gates as units of each size erected.

1.4 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A90/A90M-01, Standard Test Method for Weight of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A121-99, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

.4 A653/A653M-03, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanised) by the Hot-Dip Process.

.5 ASTM C618-03, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.6 ASTM F1664-01, Standard Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-138.1, Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2, Steel Framework for Chain Link Fence.

.3 CAN/CGSB-138.3, Installation of Chain Link Fence.

.4 CAN/CGSB-138.4, Gates for Chain Link Fence.

.5 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-A23.1/A23.2-00(August 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-A3000-98(R2002), Cementitious Materials Compendium. Includes:

.1 CAN/CSA-A23.5-98, Supplementary Cementing Materials

.4 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.6 The Master Painters Institute (MPI) - Architectural Painting Specification Manual - March 1998.

.1 MPI # 18, Organic Zinc Rich Primer.

.7 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.5 SUBMITTALS

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

.2 Submit WHMIS MSDS - Material Safety Data Sheets.

.3 Coordinate submittal requirements and provide submittals required.

.4 Submit Shop Drawings.

1.6 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with the Work Plan.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with the Waste Management Plan.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

.5 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

.6 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.

.7 Unused paint or coating material must be disposed of at official hazardous material collections site as approved by Departmental Representative.

.8 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Fold up metal banding, flatten and place in designated area for recycling.

1.9 SUSTAINABLE REQUIREMENTS

.1 Concept Design Strategy:

.1 Concept Design strategy requirements form integral part of this project including materials and products of this Section which include:

.1 Descriptions of design criteria.

.2 Sustainability goals are delineated with measurable performance targets.

.3 Operational requirements are specified to transform design requirements into physical (site and building) requirements.

.2 Construction:

.1 Construction requirements form integral part of this project including materials and products of this Section and include:

.1 Specific construction requirements for project.

.2 Administrative, temporary and procedural requirements for the use of materials and methods of construction.

.3 Verification:

.1 Contractor's verification form integral part of this project. Verification requirements include:

.1 Verification of performance requirements and expected results included in Concept Design.

.2 Compliance with sustainable requirements specific to this technical section.

.4 Operation:

.1 Operation requirements: Operation form integral part of this projects. Operation requirements include:

.1 Products, materials, services, and methods used in operation and maintenance of building consistent with procurement policy of eco-purchasing that reduces volume of wastes, material costs, toxicity of products and supports recycling.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 – Cast-in-Place Concrete.

.1 Nominal coarse aggregate size: 20-5 mm.

.2 Compressive strength: 20 MPa minimum at twenty-eight (28) days.

.3 Additives: fly ash to CAN/CSA-A23.5.

.2 Chain-link fence fabric: to CAN/CGSB-138.1.

.1 Type 1, Class A, medium style, Grade 1.

.2 Height of fabric: as indicated.

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.

.4 Top and bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized coated steel wire.

.5 Tie wire fasteners: steel wire.

.6 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

.7 Gates: to CAN/CGSB-138.4.

.8 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.

.1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.

.2 Fasten fence fabric to gate with twisted selvage at top.

.3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.

.4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.

.9 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.

.1 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.

.3 Projection of approximately 300 mm long to project from fence at 45 degrees above horizontal.

.4 Turnbuckles to be drop forged.

.10 Organic zinc rich coating: to CAN/CGSB-1.181.

.11 Grounding rod: 16 mm diameter copper well rod, 3m long to Section 26 05 28 - Grounding – Secondary.

.12 Provide ground straps between fence sections to Section 26 05 28 - Grounding – Secondary for continuity of grounding along entire fence route. Bond fencing to ground rods at locations shown on drawings.

2.2 FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1 Grade2.

.2 For pipe: 550g/m^2minimum to ASTM A90.

.3 For other fittings: to CAN/CSA-G164.

Part 3 Execution

3.1 GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

.1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 ERECTION OF FENCE

.1 Erect fence along lines as indicated and to CAN/CGS-138.3.

.2 Excavate post holes to dimensions indicated.

.3 Space line posts 3m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not to exceed 150m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150m.

.5 Install additional straining posts at sharp changes in grade and where directed by Departmental Representative.

.6 Install corner post where change in alignment exceeds 10 degrees.

.7 Install end posts at end of fence and at buildings.

.1 Install gate posts on both sides of gate openings.

.8 Place concrete in post holes then embed posts into concrete to depths indicated.

.1 Extend concrete 50 mm above ground level and slope to drain away from posts.

.2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured minimum of five (5) days.

.10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface.

.1 Install braces on both sides of corner and straining posts in similar manner.

.11 Install overhang tops and caps.

.12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.

.1 Knuckled selvedge at bottom.
.2 Twisted selvedge at top.

.15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450mm intervals.

.1 Give tie wires minimum two (2) twists.

.16 Install barbed wire strands and clip securely to lugs of each projection.

.17 Install grounding rods as indicated.

3.3 INSTALLATION OF GATES

.1 Install gates in locations as indicated on drawings. Swing as indicated.

.2 Level ground between gate posts and set gate bottom approximately 50 mm above ground surface.

.3 Determine position of centre gate rest for double gate.

.1 Cast gate rest in concrete as directed.
.2 Dome concrete above ground level to shed water.

.4 Install gate stops where indicated.

3.4 VERIFICATION

.1 Verification requirement include:

.1 Materials and resources.
.2 Storage and collection of recyclables.
.3 Construction waste management.
.4 Resource reuse.
.5 Recycled content.
.6 Local/regional materials.
.7 Wood.

3.5 OPERATIONAL REQUIREMENTS

.1 Operational requirements include:

.1 Cleaning materials and schedules.
.2 Repair and maintenance materials and instructions.

3.6 TOUCH-UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two (2) coats of organic zinc-rich paint to damaged areas.

.1 Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

3.7 CLEANING

.1 Clean and trim areas disturbed by operations.

.1 Dispose of surplus material and replace damaged grass with seeding as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 Measure hydrants including excavation and backfilling, in units installed.

1.2 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA B300-10, Standard for Hypochlorites.

.2 ANSI/AWWA B301-10, Standard for Liquid Chlorine.

.3 ANSI/AWWA B303-10, Standard for Sodium Chlorite.

.4 ANSI/AWWA C104/A21.4-08, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

.5 ANSI/AWWA C105/A21.5-10, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

.6 ANSI/AWWA C111/A21.11-07, American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.

.7 ANSI/AWWA C110/A21.10-08, American National Standard for Ductile-Iron and Gray Iron Fittings for Water.

.8 ANSI/AWWA C150/A21.50-08, Standard for Thickness Design of Ductile-Iron Pipe.

.9 ANSI/AWWA C151/A21.51-09, Standard for Ductile-Iron Pipe, Centrifugally Cast.

.10 ANSI/AWWA C153/A21.53-11, Standard for Ductile-Iron Compact Fittings.

.11 ANSI/AWWA C200-05, Standard for Steel Water Pipe – 6" (150 mm) and Larger.

.12 ANSI/AWWA C203-08, Standard for Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.

.13 ANSI/AWWA C205-07, Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4" (100 mm) and Larger - Shop Applied.

.14 ANSI/AWWA C206-11, Standard for Field Welding of Steel Water Pipe.

.15 ANSI/AWWA C207-07, Standard for Steel Pipe Flanges for Waterworks Service, 4" through 144" (100 mm through 3,600 mm).

.16 ANSI/AWWA C208-07, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.

.17 ANSI/AWWA C300-11, Standard for Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.

.18 ANSI/AWWA C301-07, Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.

.19 ANSI/AWWA C303-08, Standard for Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.

.20 ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.

.21 ANSI/AWWA C504-10, Standard for Rubber-Seated Butterfly Valves.

.22 ANSI/AWWA C600-10, Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.

.23 ANSI/AWWA C602-11, Standard for Cement-Mortar Lining of Water Pipelines – 4" (100 mm) and Larger.

.24 ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.

.25 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.

.26 ANSI/AWWA C900-07, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4" through 12" (100 mm - 300 mm), for Water Transmission and Distribution.

.2 ASTM International

.1 ASTM A 53/A 53M-10, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

.2 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A 307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.4 ASTM B 88M-05(2011), Standard Specification for Seamless Copper Water Tube Metric.

.5 ASTM C 117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.6 ASTM C 136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.7 ASTM C 478M-11, Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].

.8 ASTM D 698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ftü (600 kN-m/mü)).

.9 ASTM D 2310-06, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

.10 ASTM D 2657-07, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

.11 ASTM D 2992-06, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.

.12 ASTM D 2996-01(2007)e1, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

.13 ASTM F 714-10, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.14 ASTM C 618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

.3 American Water Works Association (AWWA)/Manual of Practice

.1 AWWA M9-2008, Concrete Pressure Pipe.

.2 AWWA M11-2004, Steel Pipe - A Guide for Design and Installation.

.3 AWWA M17-2006, Installation, Field Testing, and Maintenance of Fire Hydrants.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CAN/CGSB-34.1-94, Pipe, Asbestos Cement, Pressure.

.4 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.

.5 CSA International

.1 CAN/CSA-A257 Series-09, Standards for Concrete Pipe (Consists of A257.0, A257.1, A257.2, A257.3 and A257.4).

.2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.3 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.1 CAN/CSA-B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.2 CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.4 CSA G30.18-[09], Carbon and Steel Bars for Concrete Reinforcement.

.6 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S520-07, Standard for Fire Hydrants.

.2 CAN/ULC-S543-09, Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Pipe certification to be on pipe.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.

.1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

.3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, valve boxes, valve chambers and hydrants for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hydrants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Owner.

.3 Notify Owner minimum of one hundred twenty (120) hours in advance of interruption in service.

.4 Do not interrupt water service for more than three (3) hours and confine this period between 12:00 AM and 3:00 AM hours local time unless otherwise authorized.

.5 Notify fire department of planned or accidental interruption of water supply to hydrants.

.6 Provide and post "Out of Service" sign on hydrant not in use.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Tools: provide tools as follows:

.1 Four (4) hydrant wrenches.

1.8 EXISTING SITE CONDITIONS

.1 Existing fire hydrant valve stems are between 3.0m and 4.6m below grade.

.2 It is not known if existing site domestic water isolation valves are functional.

.3 Shutting off the water to Building 9 will shut-off all domestic water to the building, this will have to be independently planned and approved by the institution.

.4 When replacing fire hydrants, the institution cannot have more than one (1) Living Unit building down at a time. The work being done on the respective hydrant must be noted and tagged to the hydrant in case the fire department attempts to use the hydrant.

.5 The type of fire hydrant to be used is to match existing fire hydrants on site that have been replaced.

.6 The size of thread on the fire hydrant to be confirmed with the Town of Drumheller Fire Department.

Part 2 Products

2.1 HYDRANTS

.1 Post type hydrants: compression type hydrant, to CAN/ULC-S520, designed for working pressure of 1034 kPa with two (2) 65 mm threaded hose outlets, one (1) 100 mm threaded pumper connection, 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main.

.1 Hydrants to open threads to local standard. Provide metal caps and chains.

.2 Depth of bury match existing.

.2 Hydrant paint: exterior enamel to MPI #96.

2.2 PIPE DISINFECTION

.1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.

.2 Disinfect water mains in accordance with ANSI/AWWA C651.

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 distribution piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner.
.2 Inform Owner of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner.

3.2 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of Owner.
.2 Remove defective materials from site as directed by Owner.

3.3 HYDRANTS

.1 Install hydrants at locations as indicated.

.2 Install hydrants in accordance with AWWA M17.

.3 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.

.4 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.

.5 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.

.6 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.4 THRUST BLOCKS AND RESTRAINED JOINTS

.1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Owner.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within twenty-four (24) hours after placing.

.5 For restrained joints: only use restrained joints approved by Owner.

3.5 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C600.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify the Owner at least one hundred twenty (120) hours in advance of proposed tests.

.1 Perform tests in presence of Owner.

.4 Where section of system is provided with concrete thrust blocks, conduct tests at least five (5) days after placing concrete or two (2) days if high early strength concrete is used.

.5 Leave hydrants, valves, joints and fittings exposed.

.6 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.

.7 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.8 Open valves.

.9 Expel air from main by slowly filling main with potable water.

.1 Install corporation stops at high points in main where no air-vacuum release valves are installed.

.2 Remove stops after satisfactory completion of test and seal holes with plugs.

.10 Thoroughly examine exposed parts and correct for leakage as necessary.

.11 Apply hydrostatic test pressure of 690 kPa minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of one (1) hour.

.12 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.13 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.14 Repeat hydrostatic test until defects have been corrected.

.15 Apply leakage test pressure of 690 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of two (2) hours.

.16 Define leakage as amount of water supplied from water metre in order to maintain test pressure for two (2) hours.

.17 Locate and repair defects if leakage is greater than amount specified.

.18 Repeat test until leakage is within specified allowance for full length of water main.

3.6 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

3.7 HYDRANT FLOW TESTS

.1 Conduct flow tests on every hydrant to determine fire flows prior to painting hydrant caps and ports.

3.8 PAINTING OF HYDRANTS

.1 After installation, paint hydrants red.

.2 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

3.9 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations: witnessed by Owner carried out by specialist contractor.

.1 Notify Owner at least fourteen (14) days in advance of proposed date when disinfecting operations will begin.

.2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum ten (10) minutes, or until foreign materials have been removed and flushed water is clear.

.3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and Below	38
8	75
10	115
12	120

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves, hydrants and service connections to ensure thorough flushing.

.6 When flushing has been completed to Owner approval, introduce strong solution of chlorine as approved by Owner into water main and ensure that it is distributed throughout entire system.

.7 Disinfect water mains to the requirements of local authority.

.8 Rate of chlorine application to be proportional to rate of water entering pipe.

.9 Chlorine application to be close to point of filling water main and to occur at same time.

.10 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.11 Flush line to remove chlorine solution after twenty-four (24) hours.

.12 Measure chlorine residuals at extreme end of pipe-line being tested.

.13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.

.1 Take samples daily for minimum of two (2) days.

.2 Should contamination remain or recur during this period, repeat disinfecting procedure.

.14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.15 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for twenty-four (24) hours.

.1 After twenty-four (24) hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.10 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Owner.

3.11 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C104/A21.4-08, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

.2 ANSI/AWWA C110/A21.10-08, American National Standard for Ductile Iron and Gray Iron Fittings for Water.

.3 ANSI/AWWA C111/A21.11-07, American National Standard for Rubber Gasket-Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 ANSI/AWWA C151/A21.51-09, AWWA Standard for Ductile-Iron Pipe, Centrifugally Cast.

.5 ANSI/AWWA C901-08, AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2" (13 mm) through 3 Inch (76 mm), for Water Service.

.2 ASTM International

.1 ASTM A 307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 Manufacturer's Standardization Society of the Valve and Fittings Industry

.1 MSS-SP-70-11, Gray Iron Gate Valves, Flanged and Threaded Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for valves, couplings and mechanical joints and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect piping materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PIPE

.1 Service water pipe: ductile iron.

.1 Ductile iron: ANSI/AWWA C151/A21.51.

.2 Cement mortar lining for ductile iron pipe: ANSI/AWWA C104/A21.4.

2.2 FITTINGS

.1 NPS 3 and larger flanged: to ANSI/AWWA C110/A21.10.

2.3 JOINTS

.1 Rubber gaskets for mechanical joints: to ANSI/AWWA C111/A21.11.

.2 Bolts, nuts, hex head with washers: to ASTM A 307, heavy series.

2.4 PROTECTIVE COATING

.1 Match existing.

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 distribution piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Owner.

.2 Inform the Owner of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code local authority having jurisdiction.

.2 Piping cut square, reamed, free of cuttings and foreign material.

.3 Lay buried piping in compacted washed sand in accordance with AWWA Class "B" bedding, where existing ground below bedding is unstable, install pipe on continuous support.

.4 Assemble piping using fittings manufactured to ANSI standards and in accordance with manufacturer's instructions.

.5 Apply one (1) layer of protective coating to buried piping.

3.3 PRESSURE TESTING

.1 Conform to Section 21 05 01 - Common Work Results for Mechanical.

3.4 DISINFECTION

.1 Coordinate with Section 33 11 16 - Site Water Utility Distribution Piping and Section 22 11 16 - Domestic Water Piping.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

APPENDIX

A GENERATOR SKID PACKAGE

DRUMHELLER INSTITUTION

CSC Drumheller Institution CHP Fire Pump Replacement

PWGSC Project No.: R.060837.001

GENERATOR SKID PACKAGE

SPECIFIC DESIGN PERFORMANCE REQUIREMENTS

July 31, 2019

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PART 1 INTRODUCTION

1.1 GENERAL

.1 The Drumheller Institution is a medium-security prison that opened in 1967 with a minimum-security annex added in 1997 and situated on the West side of the property. The Central Heating Plant (CHP) is located near the south west corner of the property, outside the secure medium-security area. This project includes the requirement for a 600kW diesel generator where the successful Generator Package Vendor (here forward also referred to as "the Seller") shall supply, install and commission a generator skid package (here forward also referred to as "the Skid Package" or "the Generator Package") complete with a 600kW diesel fired generator and all associated apparatus defined within this document. The purpose of the generator package is to provide emergency power to a new fire pump system for the site which is also within the scope of this project. In addition to the generator, the package shall include all equipment and apparatus to support the operation of the skid package, an automatic transfer switching system for primary and generator power for the package, three (3) circuit breakers installed directly on the generator (one (1) for power to the skid package, the other two (2) for connecting directly to each of two (2) fire pumps via each of their respective control panels), a convenient means of connecting primary power to the skid package. A 600kW load bank, shall be supplied and shipped loose for installation outside on the site by the General Contractor under direction by the Seller.

.2 This document contains the scope of work for the contractor to provide a standalone skid mounted modular building (the skid package) complete with all required apparatus to house the one (qty 1) prime 600kW generator and all supporting apparatus described within these specifications, hereforth referred to as the "Generator Package".

.3 The General Contractor shall carry all costs to engage an experienced (ten (10) years minimum experience) Generator Package Vendor to supply, deliver, install and commission one (qty 1) generator skid package in accordance with this Generator Package Specification and the global Specifications for which this document is included within its Appendix.

.4 These units shall be suitable for the design conditions as specified herein, with high reliability and availability of service and spare parts.

.5 The package shall be skid mounted within a modular building.

.6 When the generator is operating, noise attenuation shall maximum sound pressure of less than 68dB at 30 feet.

.7 The Skid Package will include and accommodate sufficient room for:

- .1 One (1) 347/600V VAC/3ph 600 kW, Stand-by Diesel Driven Power Generator. Engine combustion air intakes located outside.
- .2 One (1) Skid Mounted Modular Building.
- .3 Electric unit heaters, fans, air intake louvers and motorized dampers for building/enclosure heating and ventilation.
- .4 Automated louver intake and exhaust systems integrated to generator operation.
- .5 Louver Snow hoods.
- .6 DC motor starter with batteries and automatic chargers.
- .7 One (1) Building Supervisory Control Panel c/w with BACnet MSTP tie-in for alarm and status reporting.

.8 All filters, gas regulators, gas detection, vents, accessories, interconnecting piping, fittings, valves, safety devices, controls, alarms, instrumentation, electrical, structural steel, building heating / ventilation system, coating/painting shall be included in the package.

.9 Coolant heater(s).

.10 To prevent contamination to the environment, full containment ring to retain coolant, oil lubricants, and all other fluids within the Generator Package.

.11 Emergency shutoff push button (colour: red, conspicuously labelled, "Emergency Shutdown"), one at each exit from the Generator Package.

.12 One (1) automatic transfer switch (ATS) wired to generator and exterior mounted splice box to allow for connection to utility power.

.13 Forty-two (42) circuit 347/600VAC 400A c/w main surface mount distribution panel fed from the ATS.

.14 One (1) 30kVA 600:120/208VAC dry type transformer connected from the 347/600V panel to the 120/208V panel.

.15 Forty-two (42) circuit 100 amp 120/208VAC surface mount distribution panel (with main circuit breaker) fed from the secondary side of the 30kVA transformer.

.16 Two (2) 600V electric heaters c/w integral thermostats, sized adequately such that one heater can normally heat the interior of the building.

.17 One (1) 600V 600kW 3 phase automatic variable-load load bank.

.18 One (1) indirect propane heater for emergency heating of interior of building.

.19 Sufficient lighting of the interior of the skid package.

.20 Exterior luminaires at all entrances to the building.

.21 Exterior weather-proof splice box with terminals for 347/600V utility wiring connectivity (coordinate location of box with site contractors prior to installation).

.22 Exterior weather-proof splice box for connection to load bank on-site.

.23 Exterior junction box for routing of two (2) hour fire rated cables to fire pumps (refer to single line diagram for coordination of work with the site).

.24 Interior conduit and/or cable tray to facilitate routing of cables to exteriors.

.25 Four (4) interior surface mount 120V convenience receptacles.

.26 Building grounding system and ground bar and two (2) welded ground connections on the skid for connection to grounding on site.

.27 External fueling system c/w high fuel level exterior mounted warning light.

.28 External amber beacon that initiates on alarm signal from generator control panel.

.29 All other apparatus required as defined throughout this document.

.8 The Generator Package Vendor shall provide the following services:

.1 Equipment transportation to the CSC Drumheller Institution site;

.2 Equipment installation at CSC Drumheller Institution site;

.3 Truck loading/unloading facility

.4 Assist Electrical Contractor with site installation of load bank and connection of the load bank to the generator building at the CSC Drumheller Institution site.

.5 Interconnecting piping and valves from the propane fuel system to the skid fuel system (regulator).

.6 Interconnecting power and control wiring.

.7 Specification of the foundation design and requirements for the Generator Package based on available and supplied soil conditions and geotechnical report. The Generator Package Vendor shall carry the cost for local

.8 Assist the Electrical Contractor with connection to field wiring and site grounding system. Coordinate efforts during design of Generator Package.

.9 The General Contractor shall be responsible for:

.1 Construction of the equipment foundation as required to install the Generator Package as directed by the Generator Package Vendor.

PART 2 DESIGN CONDITIONS

2.1 GENERAL

.1 Obtain and reference the complete "CSC Drumheller Institution CHP Fire Pump Replacement" book specifications, drawing package and addenda for complete project requirements.

.2 As a Sub-Contractor, the Generator Package Vendor shall support the efforts of the General, Mechanical and Electrical Contractors and other stakeholders in order to deliver the successful installation of the fully functioning Generator Package.

PART 3 SITE CONDITIONS

3.1 GENERAL

.1 The General Contractor shall ensure that a complete set of Project drawings in PDF format shall be made available to the Generator Package Vendor.

.2 The site information is detailed in the geotechnical report and site drawings.

.3 The Genertor Package Vendor shall carry the cost for the General Contractor to perform a test pit for verification of area specific geotechnical conditions as part of the structure design costs.

.4 The area where this generator package shall operate is classified as "non-hazardous"/"non-rated" area.

.5 Ensure all intake louvers/vents will not be blocked by snow drifts, minimum 1.5 m from grade to bottom louvers and dampers.

.6 Elevation: 700m ASL

.7 Ambient temperature range (summer/winter): +30°/-40° C.

.8 The Seller shall advise the Departmental Representative if the generator package shall require de-rating for site conditions.

PART 4 EQUIPMENT, MATERIALS AND LABOUR SUPPLIED BY VENDOR

4.1 GENERAL

.1 In general, all equipment, materials and labour required to complete the work in accordance with the documents shall be provided by the Vendor. This includes, but is not limited to what is described in the following paragraphs.

.2 Vendor shall furnish all engineering, labour, supervision, payroll burdens, subsistence, consumable supplies, construction utilities, tools, and all other items necessary to properly carry out the work as outlined in the documents.

.3 Vendor shall supply enclosures for the purpose of storing materials requiring protection from weather damage and/or theft as required.

.4 All supplied electric or electronic equipment shall be approved by an accredited agency and bear its label. It shall be the Vendor's responsibility to have CSA or equivalent accredited inspection carried out on all custom fabrication and non-pre-certified equipment, and pay for all associated fees to do these inspections. Vendor shall provide copy of the accredited agency report.

.5 Minimum of 750 mm of wall space shall be left available for future supplied controls/communication/instrumentation/weather systems.

.6 Vendor, at its expense, shall provide all services necessary to complete the work including but not limited to the following:

.1 Preparation of all shop drawings and documentation required for the production of the Generator Package. Submit to Engineering Consultant for review prior to procurement and commencement of construction

.2 Supply and installation of all materials, equipment and instrumentation;

.3 Receiving, offloading and setting of equipment at Vendor's shop;

.4 Supply and fabrication of skids and all structural steel;

.5 Supply of complete Generator Package buildings/enclosures;

.6 Shop assembly and alignment checks of all components with final witnessing performed by Engineering Consultant prior to delivery to site;

.7 Supply and installation of piping,

.8 Supply and installation of manual and automatic control valves

.9 Supply and installation of tubing and tube fittings;

.10 Supply and installation of instrumentation and electrical materials;

.11 Non-destructive inspection of piping welds, as required;

.12 Surface preparation, priming and finish painting;

.13 Four (4) hour full load <u>witnessed</u> run test at vendor's shop;

.14 Hydrostatic testing of piping strictly to ASME B31.3 (as required);

.15 Preparation of skid for shipment;

4.2 DIESEL FUEL SYSTEM

.1 The Seller shall supply and install within the Skid Package a diesel fuel system capable of providing twenty-four (24) hours of run time. The Seller shall also attend and carry all costs for coordinating the testing and commissioning (both off-site and on-site) of the fuel-generator systems.

.2 The design shall meet all latest Code requirements,

.3 The Vendor is to specify the criteria for sizing the piping, valves, regulators, vents and all other fuel system apparatus.

.4 The Vendor shall provide drawings, schedules, data sheets, bill of materials, QA/QC plan and test reports for the Engineering Consultants review and approval.

4.3 PIPING AND VALVES

.1 The Vendor shall be responsible for the design, fabrication, installation, radiography and testing of all piping, valving, etc.

.2 The Vendor shall be responsible for purchasing and installing all piping, valves and fittings required for complete, operable systems.

.3 Piping must be arranged to allow adequate operation and maintenance avoiding tripping hazard. Whenever possible, piping shall be laid down parallel to the skid edges.

.4 Vendor shall provide ANSI 150# and 300# RFWN fittings

.5 All piping/tubing entering and leaving the skid shall be supported at the skid edge and shall be terminated with a flanged or a tube fitting connection.

.6 All piping and fittings shall conform to the appropriate piping specification for the service onto which they will be installed;

.7 Threaded connections must be avoided.

.8 The Vendor shall provide high point vent valves and low point drain valves on package piping as required.

.9 All flanged openings shall be capped with full face covers and rubber gaskets, and securely attached with a minimum of four (4) bolts.

.10 The Vendor shall supply, install and adjust pipe supports, support rods, clamps, U-bolts, etc.

.11 The Vendor shall include adequate pipe support systems for vibrating service, as applicable.

.12 Materials shall be unloaded and stored in such a manner as to prevent damage or deterioration.

.13 Letters of material compliance shall be obtained by Vendor for all piping components.

.14 All non-destructive testing shall be performed by the Vendor prior to hydrotesting.

.15 When applicable, all pressure piping shall be hydrotested per ASME B31.3 and ABSA. A pressure and temperature recorder shall be used on all hydrotests. The pressure and temperature recorder must be checked and certified by a competent instrument company one week prior to its use.

.16 All piping shall be drained and blown dry following hydrostatic test.

.17 When applicable, hydrostatic testing shall be performed with biodegradable or methanol-water based winter fluid regardless of location and time of the year.

.18 Vendor shall provide sufficient space on the skid platform around the radiators, fans and motors for service accessibility.

4.4 DRIP PANS

.1 Drip pans shall be supplied and installed where there is a possibility of drips from piping and equipment.

.2 Drip pans shall be made of light plate and sloped towards one end with a supplied 1-1/2" NPS ball type drain valve.

.3 A containment rim shall be provided around the skid edge. The height of the rim shall be adequate to contain the volume of the total volume of all fluids present in the Generator Package.

4.5 INSTRUMENTATION & CONTROLS

.1 The Vendor shall supply and install all instruments, instruments on equipment, instrument supports, drains, tubing, fittings, steel raceways, air supply branch lines and any other items that will make each instrument loop safe and operable.

.2 The Vendor shall supply sufficient battery storage and 120V power to provide constant power the generator PLC, ATS, life safety and security systems.

.3 The Vendor shall supply one (1) copy of the PLC and HMI program on flash drive

.4 The Generator Control Panel shall provide (but not limited to) the following signals:

.1 remote start
.2 remote shutdown;
.3 remote run status;
.4 remote trouble status;
.5 general alarm
.6 over-temp alarm
.7 low oil pressure alarm
.8 fuel level
.9 low fuel alarm

.5 The BACnet Building Control Panel and its associated required apparatus shall provide the following monitoring, communication and performance:

.1 Communicate all points received from the Generator Control Panel outlined in items 4.5.4.3 through 4.5.4.1.9 to other site BACnet control panels installed under this project (refer to project specifications for these additional panels).

.2 Two (2) mechanical contacts and apparatus installed on the fire pump circuit breakers to monitor assurance that the breakers are in the 'ON' position.

.3 Building / enclosure temperature measurement

.4 Low ambient temperature alarm.

.5 Monitor the building for intrusion.

.6 Signal the amber beacon on the outside of the building when an alarm condition is present.

.7 Have a minimum two (2) additional spare contacts for integrating future signals.

.6 The Control Panel shall have the capacity for reporting signals via a BACnet MSTP communications link.

.7 The Generator Package Vendor shall assist with on site Generator Package Commissioning which shall include integrating signals to remote monitoring using BACnet MSTP.

.8 The Generator Package Vendor shall provide one stand alone remote panel with BACnet MSTP communications link complete with HMI display reporting all signals defined under 4.5.4.1 through to 4.5.4.8 inclusive. This panel shall include one audible general alarm.

.9 The Generator Package Vendor shall attend the required on-site coordination work for tie-in and commissioning of the remote panel tie-in and confirmation of proper reporting of those signals.

4.6 ELECTRICAL

.1 The Vendor shall be responsible for wiring the instruments to the local control panels.

.2 Each separate piece of equipment shall be provided with a grounding point bonded to the equipment metal framework, ready for purchaser connection. All electrical components and enclosures shall be grounded.

.3 Cable trays entry points shall be from the top with enough height to allow personnel to walk safely under the trays.

.4 The generator shall be equipped with a charging system for the starter batteries to automatically ensure optimum energy levels at all times.

.5 All electrical and instrumentation shall be CSA approved.

.6 The GENERATOR PACKAGE building will be **unclassified**.

.7 The electrical distribution criteria are as follows:

.1 Power requirements: 347/600VAC 3 phase 60 hertz:

.2 The Generator Package Vendor shall include service outlets (110V single phase and 208V/3ph) and 120V building lighting.

.3 Supports, terminals and any other accessories for fire pump power and controls cabling shall comply with requirements for 2 hours fire rated cables; refer specifically to Section 26 05 21 (Wires & Cables (0-1000V)) for these requirements and coordinate with the site contractors regarding them.

.4 The Vendor shall supply individual junction boxes mounted on the outside of the building as follows:

.1 347/600V junction box for 4 wire connection to the generator for normal utility power.

.2 347/600V junction box for routing two (2) hour fire-rated cable from dedicated circuit breaker on generator to fire pump controller.

.3 600V 3 wire connection to 300kW load bank on site.

.5 Insulation Class H.

.6 RTD's two (2) per phase – three (3) per phase shown on data sheet, so one (1) RTD per phase is spare.

.7 Wye connected, neutral point to be brought out to a junction box

.8 Metering – a digital link (Ethernet) to the vendor generator controller is expected to be able to provide all available metering information.

4.7 STRUCTURAL STEEL

.1 The Generator Package Vendor shall supply all necessary design, materials, labour and equipment for the complete fabrication of structural steel including major structural members, pipe supports, temporary shipping bracing, lifting lugs, checker plate, plain floor plate, in-skid drain sumps, etc.

.2 Checker plate shall be locally removable at locations of welding skid to the foundation.

.3 All equipment shall be installed on steel skid suitable to be transported in Alberta. The Generator Package shall be supplied on its own skid. The skid shall be designed and constructed to withstand harmful deflections during lifting, transporting and in-situ operation. The skid shall also be designed and constructed to transmit equipment generated forces (static and dynamic) and couples to the foundation.

.4 The Generator Package Vendor supplied lifting lugs shall be suitable to lift the skid mounted assembly including all equipment and piping.

.5 The Generator Package Vendor shall supply structural steel drawings showing skid weight, package weight, weights for individual package components and skid design pile locations.

.6 Pile/pad design loads shall be based on dynamic analysis and signed by a professional engineer to practice in the Province of Alberta.

.7 Equipment shall be mounted on skid load-bearing structural members and secured by bolting, or welding.

.8 The Generator Package shall include a containment rim with tie-in flange for truck connection.

.9 The Vendor shall supply all design, materials, labour and equipment for complete installation of any miscellaneous pipe supports that are required for pipe stability. This also applies to any other miscellaneous steel required for any other purpose to provide a complete, operable package. Supports and braces shall not be attached to unsupported floor plates.

.10 Vendor shall provide temporary foundations in his shop of adequate size to properly support and prevent settlement of the skids during assembly.

.11 The structural steel base of each skid shall be set level within a tolerance of plus/minus 1.5 mm prior to assembly.

.12 Skid flooring shall be 6 mm oil-field type checker plate where applicable. All floor plates shall be continuously welded to provide a liquid tight floor.

.13 No splices will be allowed of the structural steel members without customer approval and an approved splicing procedure.

.14 All welding shall conform to CSA W59-M, welders and welding operators shall be certified to the Canadian Welding Bureau, in accordance with W47.1-M (Division 1 or 2.1).

.15 Welding electrodes shall be E480XX, conforming to CSA W48.1-M.

.16 Structural steel drawings shall be stamped and signed by a Professional Engineer registered to practice in the Province of Alberta.

4.8 PAINTING

.1 The Vendor shall prepare and paint all equipment, structural steel, and piping as per this specification. Obtain approval from PSPC for colour selection prior to commencement of work.

4.9 BUILDINGS / ENCLOSURES

.1 The Vendor shall supply a skid mounted package c/w a modular building.

.2 The modular buildings shall be provided with the following:

.1 One (1) steel single door and one (1) steel double door (18 ga. doors, 16 ga. frames) minimum R-value of 7, with locking panic hardware and hydraulic door closures. The quantity of doors shall depend on the size, configuration of the building, standards and local construction codes. Door location and size shall allow for convenient removal of generator. Number of doors and locations shall meet Code requirements. Locations of doors shall be coordinated with fence gates on site with the General Contractor. Coordinate door locations with louvres and exhaust fans. Coordinate door locations with the location of the Vendor supplied load bank on-site.

.2 Allow for roof snow loading in accordance with the National Building Code.

.3 Other accessories to be included are: eave troughs, downspouts, ice rakes, and door canopies.

.4 All openings in building walls and roofs are to be flashed.

.5 The Fabricator shall supply a building drawing showing HVAC equipment locations and specifications. The building drawing shall be stamped by a Professional Engineer registered to practice in the Province of Alberta.

.6 The buildings / enclosures are to be unclassified.

.7 Fire detection: for each exit, minimum two (2) fire alarm pull stations (minimum two (2) exits to building, one pull station per exit), two (2) smoke detectors, and two (2) fixed temperature heat detectors wired to terminal box for tie in to the facility's fire alarm system.

.8 Fire alarm: two (2) interior-rated visual/audible fire alarm devices, one (1) exterior-rated visual/audible (installed on outside of building).

.9 Intrusion detection system.

.10 Walls to have a minimum R Value of 28.

.11 Roof to have a minimum R Value of 39.

.12 Floor to have a minimum R Value of 15 (spray foam to underside of skid).

.13 Operable louvers to be equal to TAMCO Series 9000BF.

4.10 SHIPMENT PREPARATION AND SHIPPING

.1 Generator Package Vendor shall pre-assemble the Generator Package to the maximum extent possible so as to minimize field assembly.

.2 The Generator Package Vendor shall remove all sensitive instruments or internals and protect for shipping purposes.

.3 Any instruments or other components shipped loose shall be suitably crated for shipment and shall be clearly tagged as to their intended location. All items shipped loose must accompany the skid.

.4 No components shall be shipped loose unless components have been previously installed on skid to ensure correct fit-up and subsequently removed.

.5 The Generator Package Vendor shall supply and install packing, closures and protective covers for the protection of installed materials and equipment during transportation. This shall include as a minimum the following items:

.1 Wooden covers with rust prevention for open flanges and buttweld valves;
.2 Plastic caps on open pipe and tracer ends; and,
.3 Plugs or caps for threaded ends of pipe.

.6 The Generator Package Vendor shall brace securely all items subject to movement/damage during module transportation to the jobsite:

.7 A final check shall be made and documented prior to shipment to ensure all structural and flange bolts are tight.

.8 Generator Package Vendor shall load the module onto a truck for shipment and shall ensure it is adequately supported. Preparation for shipment is the responsibility of the Generator Package Vendor c/w itemized list for all ship loose items contained within.

.9 The Generator Package Vendor is to notify the Engineering Consultant of the shipping time and date with at least three (3) labour days prior to shipment.

.10 Generator Package Vendor is responsible for shipping, delivery, off-loading, installation and commissioning of the Generator Package.

4.11 GENERATOR PACKAGE CONTROL SYSTEM PROGRAMMING

.1 The Generator Package control panel shall be programmed by the Generator Package Vendor. The program shall meet the requirements of CSA B149.3.

.2 After the systems are commissioned and have passed testing, the Generator Package Vendor shall allow for one (1) day (eight (8) hours per day) for on site for training of CSC Drumheller Institution Operations Personnel.

PART 5 REFERENCE AND CODES AND SPECIFICATIONS

5.1 GENERAL

.1 The Vendor shall adhere to all Provincial and Federal Codes and regulations as applicable. These codes include, but are not limited to, the following:

.1 American Society of Mechanical Engineers (ASME);
.2 American National Standards Institute (ANSI);
.3 American Welding Society (AWS);
.4 Welding Research Council Bulletin 107;
.5 National Electrical Manufacturer's Association (NEMA);
.6 American Society for Testing and Materials (ASTM);
.7 National Association of Corrosion Engineers (NACE);
.8 Institute of Electrical and Electronics Engineers (IEEE);
.9 Canadian Electrical Code;
.10 Instrument Society of America (ISA);
.11 Canadian Standards Association (CSA);
.12 Alberta Safety Codes Act;
.13 National Building Code of Canada (NBC), including supplements,
.14 Alberta Building Code (ABC);
.15 Alberta Occupational Health and Safety (OH&S);
.16 Alberta Energy Resources Conservation Board (ERCB) Directives;
.17 Canadian Council of Ministers of the Environment (CCME);

.2 The Generator Package Vendor shall comply with all applicable Project Specifications listed in the "Table of Contents" (this document being a part of) as well to those standards/codes referred therein.

.3 In case of requiring any additional specification referred but not included in the bid package (specifications and drawings), the Generator Package Vendor shall duly request for it.

PART 6 VENDOR DATA REQUIREMENTS

6.1 GENERAL

.1 Design documentation as outlined within this section is required for review by the Consulting Engineer.

.2 The Generator Package Vendor shall carry the cost and coordinate the production of the following items (in the form of Issued for Construction versions) which shall be P.Eng. (Alberta) stamped (the design costs of which shall be carried by the Vendor):

.1 Skid and Structural Steel Drawings.

.2 Building Drawings

.3 Foundation Design for the Skid/Building, refer to electrical drawing E4.0 for criteria

.4 Foundation Design for the load bank

PART 7 PROJECT SCHEDULE AND COORDINATION

7.1 GENERAL

.1 The Generator Package Vendor shall provide a detailed fabrication schedule for approval within five (5) business days of award of contract. This schedule shall be continuously monitored and updated as required.

PART 8 AS-BUILT DRAWINGS, O&M MANUALS & DATA BOOKS

8.1 GENERAL

.1 At the completion of the work, the Generator Package Vendor shall provide a complete set of "As-Built" drawings, operating manuals, and data books as per the attached Vendor Data Requirements form.

.2 The Generator Package Vendor must provide one (1) preliminary copy, to ship with the Generator Package, of all operating manuals and data books.

PART 9 EQUIPMENT GUARANTEE

9.1 GENERAL

.1 The Generator Package Vendor shall guarantee that all equipment will perform according to the design conditions identified in this document and the attached datasheets.

.2 Should the equipment fail to meet the above stated guarantee, the Generator Package Vendor shall take immediate action as deemed necessary, which may include modifying or replacing one (1) or more pieces of equipment, in order to satisfy the above stated guarantee, at no additional cost to the Project.

.3 The Generator Package Vendor shall provide a two (2) year full service and parts warranty on all equipment, systems and supporting systems defined within this document and serve the facility as the Generator Package.

PART 10 QUALITY ASSURANCE

10.1 GENERAL

.1 The PSPC appointed inspector may audit any of the following areas at his discretion.

- .1 Suitable methods of marking and segregating materials;
- .2 Welder certification and testing procedures;
- .3 Surface preparation and coatings;
- .4 NDE procedures and proposed Sub-contractors;
- .5 Hydrostatic testing procedures,
- .6 Generator Package Vendor's QC manual and procedures.
- .7 Thermal Insulation and vapour barrier, and
- .8 Electrical Installations

.2 The inspectors shall have full access to all relevant documents and activities during the Generator Package Vendor's working hours. The Generator Package Vendor is to provide three (3) days notice prior to testing, to allow client sufficient time to schedule witness testing activities. Inspector to provide shipping release upon satisfactory completion of all deficiencies prior to shipping.

PART 11 CONFLICTING REQUIREMENTS

11.1 GENERAL

.1 Any unresolved conflict shall be referred to WSP Canada Inc. for clarification prior to fabrication.

PART 12 SITE DRAWINGS

12.1 GENERAL

.1 The Vendor shall obtain and refer to the **CSC Drumheller Institution CHP Fire Pump Replacement (PWGSC Project No.: R.060837.001)** Site drawings and shall adequately familiarize themselves to the site requirements and conditions.

END OF SECTION

APPENDIX

B OWNER'S PROJECT REQUIREMENTS (OPR)

Project Name:	**CSC – Drumheller – N – CHP Fire Pump Replacement**
Project No.:	R.060837.001 – 530-3204 (WSP # 181-01555)

Purpose: The OPR contains the owner's vision for the project. This document will guide the commissioning efforts.

A. Owner and User requirements

The Existing Fire Pump was installed when the Institution was built in the mid 1960's and is located in the northeast corner of the Central Heating Plant. It is Single speed (not capable of variable speeds), 75 hp, 550 volt, 100 psi, Darling 1000 USGPM system. It is surrounded by water pipes and is not in the vicinity of an exterior door. Problems with annual fire pump testing is in non-compliance with FNCC and NFPA 25. The existing water pipes surrounding and leading to/from the existing fire pump are coated with asbestos materials. The electrical wiring and conduit for the existing fire pump comes up through the concrete floor next to the concrete base that it currently sits on. The electrical panel controlling the unit is on the West side of the CHP.

The following are the Owner and user requirements:

SUMMARY OF DESIGN WORK

GENERAL

Mechanical:

1. Replace the existing single speed fire pump (P13) located in the Central Heating Plant (CHP) at the Drumheller Institution with a new variable speed fire pump (with a pressure release valve) that will provide the necessary emergency water flow to the complete site for all of the buildings at the Institution now and for the near future (i.e. 5 years minimum);
2. The new design must meet the direction established by CSC (Authority Having Jurisdiction at this site) to use NFPA 20 (2010), article 9.2.2.4. Refer to Appendix A;
3. Filling of domestic water storage tanks (2 in CHP) and water tower to be automated. (Refer to Appendix B for description of existing tanks and tower).

Electrical:

1. The fire pump shall be installed in accordance with NFPA 20;
2. Provide all necessary means to protect the fire pump and equipment – forming part of a fire protection system - from freezing;
3. Electrical conductors shall conform to ULC-S139, "Fire Test for Evaluation of Integrity of Electrical Cables", including the hose stream application to provide a circuit integrity rating of not less than 2 hours, or be located in a service space that is separated from the remainder of the building by a fire separation that has a fire-resistance rating of not less than 2 hours.
4. Provide indication of a supervisory signal to fire department and to the Institution's fire protection system;
5. Provide interconnection supervision for the Fire Alarm System including, but not limited to;
   a) Movement of a valve handle that controls the supply of water to sprinklers,
   b) Loss of excess water pressure required to prevent false alarms in a wet pipe system,
   c) Loss of air pressure in a dry pipe system,
   d) Loss of air pressure in a pressure tank,
   e) A significant change in water level in any water storage container used for firefighting purposes,
   f) Loss of power to any automatically starting fire pump.

APPENDIX

C

CSC DRUMHELLER INSTITUTE CHP FIRE PUMP REPLACEMENT COMMISSIONING PLAN – DECEMBER 20, 2018

PUBLIC SERVICES AND PROCUREMENT CANADA (PSPC)/
CORRECTIONAL SERVICES CANADA (CSC)

CSC DRUMHELLER INSTITUTION CHP FIRE PUMP REPLACEMENT

COMMISSIONING PLAN

DECEMBER 20, 2018

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3	REVISION 4
Remarks	SD Draft Cx Plan	SD Cx Plan	SD Cx Plan	SD Cx Plan	DD Cx Plan
Date	March 16, 2018	March 22, 2018	August 10, 2018	October 23, 2018	December 20, 2018
Prepared by	Mike Edwards	Mihir Shah	Mihir Shah	Mihir Shah	Mihir Shah
Signature					
Authorised by	Doug Cargill				
Signature					
Project number	R.060837.001 – 530-3204 (WSP # 181-01555-00)				

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1 SUMMARY

1.1 COMMISSIONING

Commissioning is the quality assurance process of moving the facility from the 'static completion' to the optimal 'dynamic' operating state. Building systems are checked for proper and complete installation, and then tested to verify proper functioning of both individual components and the total systems. The goal and overriding purpose is to verify that the building performs as per the design intent and meets the Owner's operational needs.

The Commissioning Plan provides the details for the implementation of the commissioning process.

- Outlines and describes the commissioning process and the objectives of the commissioning
- Identifies the members of the commissioning team and their roles and responsibilities in the commissioning process
- Documents the commissioning process for future references in operating and maintaining the facility
- Schedules the commissioning activities for testing, verification, and training of O/M staff

1.2 COMMISSIONING OBJECTIVES

- Support quality management through monitoring and checking of the installation.
- Verify system performance through testing and commissioning of the completed installation.
- Move the completed facility from the 'static completion' state to the optimal 'dynamic' operating state.
- Optimize operating and maintenance through delivery of comprehensive quality training and instruction to the Owner's operating personnel.
- System debugging and optimization.
- Completion of testing and verification through seasonal review.

1.3 REFERENCES

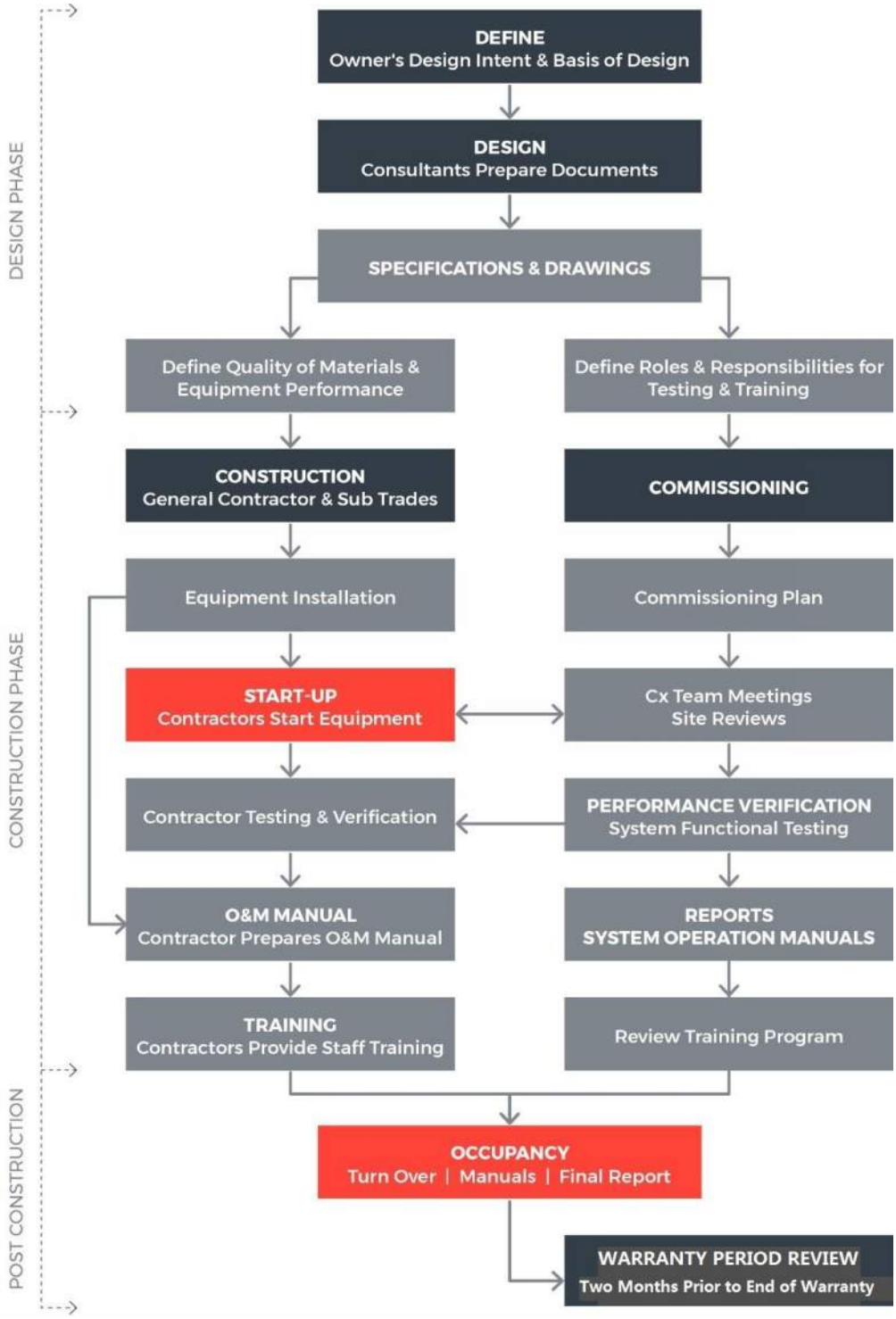
- Z320-11 (R2016) - Building Commissioning Standard.
- NFPA 4, Standard for Integrated Fire Protection and Life Safety System Testing.
- CAN/ULC-S1001-11 Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

2 COMMISSIONING PROCESS OVERVIEW

There are five main project phases, the concept design phase, design phase, construction phase, acceptance phase and post-acceptance phase. For each of these project phases, the various commissioning activities, and milestones are identified below.

The commissioning milestones are related to key events and deliverables throughout the commissioning process and are described fully in Section 3.

2.1 COMMISSIONING PROCESS FLOW CHART



2.2 COMMISSIONING PHASES

2.2.1 PRE-DESIGN PHASE

- Owner's Design Intent documentation developed and distributed.
    - WSP Group has produced a sustainable design intent for this project which highlights the sustainable and energy efficiency goals of the project.
- Design team members on the Commissioning Team identified
- Design team commissioning roles and responsibilities reviewed with team members
- Architectural, mechanical and electrical Basis of Design (Design Brief) reviewed.
    - The Basis of Design for this project is captured in the outline spec which has been updated as the project progressed.

2.2.2 DESIGN PHASE

- CxA provides early design review at approx 100% DD.
- Design Consultants respond to the design review in writing
- CxA provides pre-tender design review at 80% construction drawings and specifications.
- Design Consultant responds in writing.
- Further commissioning meetings held with design team members to discuss design requirements and review commissioning comments as necessary.
- Commissioning specification finalized for inclusion in tender package including:
    - Commissioning team roles and responsibilities
    - Communication protocol
    - Equipment and systems included in commissioning
    - Preliminary Installation verification checklists
    - O&M manual requirements
    - O&M training agenda

2.2.3 CONSTRUCTION PHASE

- CxA issues finalized Installation verification Checklists.
- Construction team members of the Commissioning Team identified
- Commissioning kick-off meeting held to explain construction phase commissioning process, roles and responsibilities with team members
- Shop drawings reviewed for conformance with energy efficiency requirements, maintenance needs and other issues in conjunction with the design engineers
- CxA provides periodic inspections of the systems to be commissioned in order to provide assistance with identification of potential installation issues of concern
- Periodic commissioning meetings held with trades to ensure commissioning requirements are understood, review deficiencies as necessary, coordinate equipment start-ups, pre-functional testing and functional performance testing. In particular, meetings will require attendance by:

- PM
- General Contractor
- Mechanical Contractor
- TAB (Balancing) Contractor
- Controls Contractor
- Electrical Contractor

- Contractors named above submit completed Installation Verification Checklists.
- TAB (Balancing) contractor issues a detailed pre-balancing inspection report.

2.2.4 ACCEPTANCE PHASE

- Contractor submits installation verification / start-up reports
- CxA reviews and spot-checks Installation Verification Checklists and start-up reports.
- TAB (Balancing) contractor submits a draft of the final balancing report.
- Functional performance Testing begins:
  - CxA spot checks balancing and modes of operation with TAB and controls contractors.
- Design consultant reviews, witnesses and signs-off on commissioning forms and check sheets before and after equipment being verified as an acceptance of compliance to design intent
- CxA reviews O&M manuals and as-builts to verify they are complete.
- CxA oversees owner training provided on the operation, adjustment, maintenance and safety requirements of commissioned systems.
- Some functional performance testing is seasonally dependant and deferred until weather conditions permit.
- CxA generates final commissioning report including all results from installation verification, start-up, functional testing, training, and reviews of the O&M manuals and as-built drawings for submittal to the Owner
- CxA generates re-commissioning manual for Owner's on-going verification of systems and continued acceptable operational performance

2.2.5 OPERATION PHASE

- Deferred testing performed as weather conditions and operational conditions in the facility allow.

Final review of any deficiencies or warranty items identified over the warranty period.

3 COMMISSIONING WORK PRODUCTS

3.1 DESIGN PHASE

The design intent is established by the Owner and the basis of design is provided by the consulting team. The commissioning requirements are developed and incorporated into the contract document

3.1.1 OWNERS PROJECT REQUIREMENTS (OPR) (BY OWNER, ARCHITECT)

The OPR is prepared or assembled by the Owner and Architect to properly reflect the Owner's intent and requirements for the services the building will deliver. The OPR documents the owner's requirements for the building and systems including HVAC, lighting, indoor environment, energy efficiency, siting, water and environmental responsiveness. This is a living document that will evolve as the project and design evolve.

3.1.2 BASIS OF DESIGN (BOD) (BY ARCHITECT, DESIGN ENGINEERS)

BOD (or Design Brief) is prepared in three parts by Architect, Mechanical Engineer and Electrical Engineer. The BOD documents the designers' proposals for meeting the requirements of the OPR, and includes information on items that influence design decisions such as occupancy, space and process requirements, codes and standards, load and climatic assumptions. This is a living document that will evolve as the project and design evolve. The CxA will review and verify that the basis of design and proposed systems and strategies meet the OPR, and will prepare a summary of issues that may require attention to ensure all OPR needs are appropriately addressed.

3.1.3 DESIGN REVIEWS (BY CXA)

Design reviews are prepared by the CxA at the 50% and 95% design stages. The reviews ensure the design meets the design intent and the basis of design is adhered to, and focus on the systems to be commissioned with respect to functionality, energy performance, maintainability, sustainability, system cost, indoor environmental quality, and environmental impact.

3.1.4 SPECIFICATIONS (BY ARCHITECT, DESIGN ENGINEERS)

Commissioning specifications are developed by the architect and design engineers with assistance from the CxA. Specifications outline the responsibilities of the contractors in the commissioning process. This includes requirements in meetings participation, submittals for review, installation verification, deficiency remediation, equipment start-up, TAB, and functional performance testing.

3.2 CONSTRUCTION PHASE

Periodic commissioning meetings are held with trades throughout the construction phase to ensure commissioning requirements are understood, review deficiencies as necessary, coordinate equipment start-ups, pre-functional testing and functional performance testing.

3.2.1 COMMISSIONING PLAN (BY CXA)

The commissioning plan (this document) is developed by the CxA and summarizes the tasks involved at each stage of the commissioning process. The document also outlines the responsibilities of each member of the commissioning Team. The Cx Plan is a living document and is updated as the project evolves.

3.2.2 CONTRACTOR SUBMITTAL REVIEWS (BY CXA)

The CxA reviews the controls submittals for commissionability and performance. The reviews ensure that sequences do not compromise the overall intent, will run as efficiently as possible, will adequately meet the Owner's requirements and environmental objectives.

3.2.3 INSTALLATION VERIFICATION CHECKLISTS (IVC) (BY CXA AND CONTRACTORS)

Installation (Pre-Functional) Checklists developed by the CxA and completed by the contractors with spot checks by the CxA and verification by the design consultant. IVC checklists review the quality of the installation including equipment condition, accessibility, serviceability, adherence to installation requirements, completeness, and operational preparedness. On major pieces of equipment, basic start-up parameters are also included such as voltage, motor amps, on/off control, and motor rotation direction. Pre-balancing inspection reports also constitute part of installation verification.

- CxA provides periodic inspections of the systems to be commissioned in order to provide assistance with identification of potential installation issues of concern
- Periodic commissioning meetings held with trades to ensure commissioning requirements are understood, review deficiencies as necessary, coordinate equipment start-ups, pre-functional testing and functional performance testing.
- Contractors submit completed Installation Verification Checklists.

3.2.4 EQUIPMENT START-UP AND BALANCING

Equipment start-up and testing dates are established and incorporated into the construction schedule. Start-up procedures, equipment start-up and balancing work are all witnessed by the commissioning authority as necessary.

- Contractor submits installation verification checklists and all manufacturer start-up reports
- TAB (Balancing) contractor submits a draft of the final balancing report.

3.2.5 FUNCTIONAL PERFORMANCE TESTING (FPT) (BY CXA AND CONTRACTORS)

FPT forms and procedures are developed by the CxA; and reviewed, verified and approveed by the Design Consultant. On-site testing is performed by the contractors under direction of the CxA. Performance testing is a collection of dynamic tests that evaluates the systems through all modes of operation. FPT verifies operation of the equipment, controls sequences and interconnected systems comply with the design intent. Some functional performance testing is seasonally dependant and deferred until weather conditions permit.

3.3 OCCUPANCY PHASE

3.3.1 O&M MANUALS (BY CONTRACTORS)

Contractors are responsible for compiling the O & M manuals for all equipment supplied. The CxA and the Design Consultant will review and comment on completeness and to ensure the information is specific to the equipment installed on-site. The main sections required include; preventative maintenance schedule, troubleshooting guide, spare parts list, contact information, shop drawings and warranty information.

3.3.2 O&M TRAINING (BY CONTRACTORS / MANUFACTURER'S REPS)

O&M training timetable is developed by the PM and contractor in conjunction with the CxA and delivered by the contractor or manufacturer's rep for each major piece of equipment or equipment type installed. The party

performing the training shall provide complete and relevant handouts to attendees. Topics covered in the training session should include:

- General description of the system and its operation including identification of major components
- Identification of operating controls and safeties including normal and abnormal sensor readings
- Review of the O&M manuals for identification of service requirements, procedures, wiring diagrams, parts identification, safety procedures, etc.
- Operational review for start-up, normal operation, shut down, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting and alarms
- Interactions with other systems and adjustments and optimizing methods for energy conservation
- Regular maintenance requirements including frequency, parts and equipment, and tools needed, replacement parts sources
- Identification of contacts for service support and maintenance parts

3.3.3 COMMISSIONING REPORT (BY CXA)

Prepared by the CxA, the commissioning report will be submitted to the owner soon after testing is complete. The commissioning report will contain the following:

- Final copies of OPR and BOD
- Copy of commissioning specifications
- Completed IVC and FPT checklists (Appendix)
- Value of commissioning process
- Outstanding commissioning issues
- Site reports history of deficiencies and corrective actions (Appendix)

3.3.4 SYSTEMS MANUAL (BY ALL PARTIES)

The systems manual is developed by the CxA and will contain the following information:

- Final version of the OPR and BOD documents.
- As-built sequences of operations for all equipment including initial schedules and set points.
- Ongoing instructions for maintaining proper operation.
- Functional performance test plan and a recommended schedule for ongoing testing.
- Seasonal operational guidelines.
- Recommendations for recalibration frequency of sensors and actuators.
- Troubleshooting table and guidelines for continuous maintenance of the owner's requirements.

3.3.5 OCCUPANT CONCERN PLAN (BY CXA)

The CxA will provide a plan for reporting of occupant concerns to the operating staff. The CxA will also work with the contractor to ensure that deficiencies are resolved before the end of the warranty period. At approximately two (2) months before warranty expiry, the CxA will review any outstanding deficiencies and occupant concerns with the Owner, occupants, their maintenance staff and contractor. The meeting will serve to finalize solutions to any outstanding issues that remain to be resolved. A final deficiency and action list will be developed. Suggestions for operational improvements will also be documented. A commitment will be obtained from the contractor as to the actions to be undertaken and the timeline for remediation of any and all warranty issues.

4 PROJECT TEAM MEMBERS AND RESPONSIBILITES

Commissioning team Contact Information specific for this project is located in Appendix A.Commissioning team members with roles and responsibilities for this project are listed below.

4.1 CLIENT/OWNER

- Define the owner's project requirements in the design intent, and provide a copy of the document to the commissioning team.
- Provide operating personnel to attend training and instruction regarding specific components, equipment and systems.
- Retain the services of independent third parties for system verification and certification as required in the document or by applicable codes.
- Observe on site installation, start up and testing of equipment and systems, during site walk-throughs and when possible.
- Review and approve commissioning documentation, including test results and reports.

4.2 CONSULTANT

- Define the basis of the design to meet the owner's requirements as detailed in the design intent.
- Review the contractors' submittals, such as, shop drawings to ensure compliance with the contract documents.
- Periodically observe the installation throughout the construction stages to determine that the installation generally conforms to the requirements of the contract documents and issue field observation reports.
- Review operating and maintenance manuals, balancing and test reports and as-builts for accuracy.
- Witness selected tests; note any deficiencies and provide field observation reports.
- Review commissioning progress reports and issues log, and address any items directed to the consultant(s).
- Review, witness and sign-off commissioning forms and check sheets before and after equipment being verified as an acceptance of compliance to design intent.

4.3 COMMISSIONING AUTHORITY (CXA)

- Participate in design team meetings. Obtain Owner's Design Intent and Consultant's Basis of Design, and system performance expectations. This will form the basis of the testing and commissioning documents.
- Review of the design and tender design documents and provide feedback to the commissioning team with emphasis on testing, commissioning, operation and maintenance of the proposed system and equipment.
- Provide commissioning documents, such as specifications and commissioning plan, to form part of the Bid documents.
- Review contractor's approved shop drawing submission for commissioning related issues.
- Develop commissioning schedule.
- Prepare the equipment test data forms.
- Monitor, check and inspect the installation throughout the construction stage.

- Supervise steps in the commissioning process including scheduling.
- Prepare and distribute commissioning issues log noting any issues that may have an impact on the commissioning of equipment and systems.
- Attend construction site meetings as required to discuss commissioning related items and any impact on Project schedule.
- Set-up and chair commissioning meetings.
- Witness and validate tests. note issues in issues log, and distribute commissioning progress reports.
- Complete system checks, system integration and failure mode testing with the Contractor.
- Work with the project team to expeditiously resolve any problems that may arise due to site conditions
- Coordinate training and instructions provided by manufacturers and suppliers. Recommendation of any additional training and/or instruction of operating and maintenance personnel deemed necessary over and above that already provided.
- Prepare Systems Operation Manual.
- Prepare and distribute the final commissioning report.

4.4 CONTRACTOR

- Manage and ensure entire installation comply with requirements of the Contract Documents.
- Submit shop drawings complete with Contractor's Stamp of Review.
- Submit working detail (interference or installation) drawings, as required
- Complete testing and commissioning forms provided by the CxA.
- Complete Owner's facilities management New Equipment forms, if applicable.
- Cubmit an installation schedule. This schedule shall include:
    - Time schedule of each activity, with lead and lag time allowed and indicated.
    - Shop drawings and working detail drawings submission.
    - Major equipment delivery and factory testing dates.
    - Coordinated installation activities and sequences in compliance with the general contractor's project schedule and other trade's installation schedule.
    - Schedule of testing and commissioning of the systems and major equipment.
- Submit a commissioning schedule. This schedule shall include:
    - Time schedule for system and equipment commissioning which are in compliance with the timing and sequences of installation schedule stated above. In this schedule allow for additional time for testing and commissioning, such that re-test of the equipment can be performed in a timely manner if required without impacting the overall project schedule or cause delay to project completion.
    - Dates for completion of required factory tests prior to equipment delivery to the site shall be indicated in the schedule.
- Prepare and submit prefunctional checklists for review and approval by the commissioning authority.
- Attend progress and commissioning meetings.
- Promptly rectify or replace reported deficiencies and defects.
- Where required by codes and/or specification, retain manufacturers and/or independent third parties to provide service for testing and certification of the systems and training of owner's personnel.
- Provide training and instruction to the Owner's operating personnel.

- Perform testing and commissioning of equipment and systems to the satisfaction of the Consultant and Commissioning Authority. Testing and commissioning will be witness by the Commissioning Authority as required. Contractor or his retain agents shall also record procedure and finding in reviewed test and record forms. Submit test and record forms with the signature of the tester for review by the Consultant and Commissioning Authority.
- Pay for and be responsible for all inspections required by codes, specification and Authorities having Jurisdiction. Obtain and submit all Certificate of Approval for such inspections and verifications.
- Submit for review as-builts drawings including those for location of control devices and wiring and operating and maintenance manuals for each equipment as per the specification requirements.
- Provide Operating and Maintenance Manuals for review by the Consultant and Commissioning Authority with all the testing and commissioning results and reports incorporated.
- Obtain, issue and assign warranties for equipment and systems to the Owner.
- Provision of all necessary test equipment shall be the responsibility of the contractor. Provide recently validated calibration certificate for all equipment to be used for verification prior to testing and commissioning commencement.
- Optimize operation according to occupant's needs, using the System Operation Manual prepared by the Commissioning Authority as reference points.
- Complete all commissioning procedures and activities and performance verification procedures which were delayed or not concluded during the commissioning phase.
- Complete system checks, once between the first and third month of building operation and once between the fourth and tenth month in a season opposite to the first or third month visit.
- Complete rectification of all deficiencies revealed by these checks. Equipment manufacturers involved in commissioning shall participate in systems checks.
- Revise all "as-built" and operating and maintenance documents to reflect all changes, modifications, revisions and adjustment upon completion of commissioning.
- Schedule a question and answer session for the operating and maintenance personnel 3 months after handover of the facility to the Owner. The duration of this session or sessions will be dictated by the number of questions or concerns that shall be addressed.

4.5 COMMUNICATIONS PROTOCOL

The following protocols will be used on this project. Requests for information or formal documentation by the CxA are handled through the normal communication channels. Minor issues may be handled through more informal discussions between the contractor, the designers or other parties directly involved and/or the CxA as appropriate.

ISSUE	PROTOCOL
Requests for information or formal documentation.	CxA goes first through the PM.
Minor or verbal information and clarifications	CxA goes direct to the informed party.
Notifying contractors of deficiencies	CxA documents deficiencies through the PM, but may discuss deficiency issues with contractors and Design Consultants prior to notifying the PM.
Scheduling functional tests or training	CxA provides input and schedule review of testing and training. Scheduling is done through the GC / PM.
Scheduling commissioning meetings	CxA requests the date and schedules through the GC / PM.

Request for significant changes	CxA has no authority to issue change orders.
Making minor changes to the installed sequences of operations	**Minor** changes in sequences of operations and graphical representations required to correct or enhance system operations may be requested by the CxA, but must be documented
Making significant changes to the installed sequences of operations	The CxA may recommend to the design engineer PM changes in sequences of operation to improve efficiency or control.
Subcontractors disagreeing with requests or interpretations by the CxA	Resolve issues at the lowest level possible. First with the CxA, then with the GC and PM. Some issues may require input from the A/E team.

The Primary Consultant/PM will ensure that the appropriate Design Consultants respond in writing to all documents issued by the CxA. The Primary Consultant/PM shall issue copies of the following documents to the CxA:

- Updated Construction drawings, specifications and addendums
- Contemplated Changes c/w all related sketches
- Change Orders c/w all related sketches
- Site instructions
- Field review reports
- Construction meeting minutes
- Request for information with response

4.6 MEETINGS

The Commissioning Authority attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in commissioning. The Construction Manager and the General Contractor provide the Commissioning Authority with information regarding substitutions, change orders, and any Engineer/ Architect supplemental instructions that may affect the commissioning of equipment, systems, or the commissioning schedule. The Commissioning Authority may review construction minutes, change orders, or site instructions for the same purpose.

Commissioning Meetings may also be scheduled during construction by the Commissioning Authority to include all of the commissioning team members. Those meetings shall address commissioning related responsibilities as well as the preparation for all specified testing, documentation, O&M manuals, training, and post-construction requirements.

4.7 PROGRESS REPORTING AND ISSUES LOG

The Commissioning Authority provides the Owner and project team with regular commissioning progress reports. These Issues Logs generally contain a list of new and outstanding deficiencies and a description of commissioning progress corresponding to the plan. The Commissioning Authority maintains a log of all commissioning related issues that require current or future attention. This record allows for clear tracking of the status of documentation and testing for each piece of equipment and each system. Information can include installer, party responsible for start-up, approval dates for check lists and test forms, their completion, training, O&M documentation review, etc.

5 SYSTEMS INCLUDED IN COMMISSIONING

The following is a list of systems to be commissioned, but not limited to the following. Refer to the project specifications for more details on the Commissioning requirements. Commissioning shall include all HVAC systems and associated controls, lighting controls, domestic hot water systems and renewable energy systems. Refer to Appendix A for a detailed list of systems to be commissioned.

5.1 SYSTEMS TO BE COMMISSIONED

5.1.1 FIRE PROTECTION EQUIPMENT

- New fire pump
- Pump variable speed drive controls
- New water tank/tower level controls

5.1.2 ELECTRICAL SYSTEMS

- Diesel generator and load bank
- Automatic transfer switch for emergency power

5.2 EXCLUDED SYSTEMS

Mechanical (HVAC systems), domestic hot and cold water systems, lighting and lighting controls, security, locks, audio/video, telephone, networking, elevators, process equipment and other specialty systems normally commissioned by the supplier / installer are not included in the scope of commissioning.

END OF DOCUMENT

APPENDIX A.

COMMISSIONING TEAM CONTACT INFORMATION

ROLE	NAME(S)	CONTACT INFORMATION
Owner	Jerry Aujla Jerry Quintel Jason Westcott	jerry.aujla@csc-scc.gc.ca jerry.quintel@csc-scc.gc.ca jason.wescott@csc-scc.gc.ca
PSPC Representative	Shawn Lumsden Marcel Banica Jeannine Nguyen	Shawn.Lumsden@pwgsc-tpsgc.gc.ca Marcel.Banica@pwgsc-tpsgc.gc.ca Jeannine.Nguyen@pwgsc-tpsgc.gc.ca
Commissioning Authority	Mihir Shah Boyd England Mike Edwards	Mihir.Shah@wsp.com Boyd.England@wsp.com Mike.C.Edwards@wsp.com
Architect	Sherri Tupin	Sherri@turpinkong.ca
Mechanical Engineer	Doug Cargill Steve Gundy	Doug.Cargill@wsp.com Steve.Gundy@wsp.com
Electrical Engineer	Keith Rogers Cyrus Mak	Keith.Rogers@wsp.com Cyrus.Mak@wsp.com
Construction Project Manager	TBD	
General Contractor	TBD	
Mechanical Contractor	TBD	
Electrical Contractor	TBD	

APPENDIX

D

ASBESTOS AND LEAD TESTING – DRUMHELLER INSTITUTE – JUNE 7, 2018

PUBLIC SERVICES AND PROCUREMENT CANADA (PSPC)/
CORRECTIONAL SERVICES CANADA (CSC)

ASBESTOS AND LEAD TESTING

DRUMHELLER INSTITUTION

DRUMHELLER, ALBERTA

JUNE 07, 2018

WSP Canada Inc.
3300, 237 – 4 Avenue SW
Calgary, Alberta
T2P 4K3

Tel: +1 403-539-9831
WSP.COM

SIGNATURES

PREPARED BY

Daria Klimenko, B.Sc. (Hons.), P.Ag., EP, CESA
Project Scientist, Environment

PEVIEWED BY

Erin Kennealy, CIH
Manager – Hazardous Materials, Environment

PREPARED FOR:

Shawn Lumsden
PSPC/CSC
Box 3000, Highway 9 South
759, 220 - 4th Avenue SE
Drumheller, Alberta
T0J 0Y0 Canada

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The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

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1 INTRODUCTION

Public Services and Procurement Canada (PSPC)/Correctional Services Canada (CSC), retained WSP to conduct asbestos and lead testing at the Central Heating Plant at Drumheller Institution, Calgary, Alberta. WSP understands that this survey was required for regulatory compliance purposes prior to the replacement of the fire pump and associated equipment. This included the need to satisfy the building owner's obligations under Section 34 of the *Alberta Occupational Health and Safety Act, Regulations and Code* (OHS) which necessitates that building owners determine if there are any hazardous materials present prior to commencement of a project (which may include construction related activities). This information allows workers and contractors to take appropriate steps to prevent accidental exposure to these harmful substances.

This investigation was conducted by Daria Klimenko and Marcus Caudill of WSP on April 6, 2018.

1.1 SURVEY OBJECTIVES

The primary objectives of WSP's survey were to:

- Identify the presence of asbestos (friable and non-friable) and lead paint on pipes and equipment by means of observation, sample collection, and subsequent laboratory analysis.
- Prepare a report documenting their locations, applications, concentrations, quantities, and conditions in the subject building to provide workers and prospective contractors with adequate information to prevent accidental exposure.
- Provide recommendations for the management, safe handling, and/or removal and disposal of hazardous material, as necessary.

1.2 SCOPE OF WORK

WSP's scope of work consisted of:

- Collection of bulk samples of materials suspected to contain asbestos;
- Collection of a representative number of bulk paint samples by scraping the paint down to the base structure in order to determine the lead concentration in all paint layers present;
- Submission of bulk samples to an accredited, independent laboratory for analysis;
- Review of analytical data for the identification of asbestos and lead-containing materials;
- Recommendations for the management/removal of identified hazardous materials.

2 REGULATORY CONTEXT

2.1 ASBESTOS

Asbestos is a naturally occurring fibrous material that was a popular building material from the 1950s to the 1990s. Use of friable asbestos was discontinued in Canada in the late 1970s and early 1980s, although the

non-friable asbestos is still found in many more recent buildings. It was used extensively for its properties including: resistance to heat, sound-insulation, resistance to burning, tensile strength, flexibility, and resistance to chemical erosion. Some of the common uses of asbestos in buildings include spray-applied fireproofing, mechanical insulation, adhesives, linoleum, floor tiles, dry-wall taping compound, zonolite insulation, cement additives, cement board, floor tiles, cement pipes, and textured decorative coating.

Asbestos fibers may become suspended in the air if asbestos containing materials (ACMs) in poor condition are disturbed. Workers and building occupants may be exposed during demolition/renovation activities. Inhaled asbestos fibres may cause fibrotic lung disease (asbestosis) and changes in the lining of the chest cavity (pleura). Long-term inhalation may increase the risk of lung cancer and mesothelioma. In Alberta, Section 34 of the *Alberta Occupational Health and Safety Act, Regulations and Code* (OHS Code; Alberta Queen's Printer, 2018) states that if a building is to be demolished, the employer must ensure that materials with the potential to release asbestos fibres are removed beforehand. Section 35 of the OHS Code (Alberta Queen's Printer, 2018) states that: if a building is being altered or renovated, the employer must ensure that materials in the area of the alterations or renovations that could release asbestos fibres are encapsulated, enclosed, or removed.

According to Section 3.2.2 of the *Alberta Asbestos Abatement Manual* (Government of Alberta, 2012), the OHS Code of practice indicates if ACM has more than 0.1% of asbestos by weight and the amount exceeds 10 kg, the employer must establish a code of practice including the storage, handling, use, and disposal of the asbestos.

According to Section 3.2.2 of the *Alberta Asbestos Abatement Manual* (Government of Alberta, 2012) the employer must comply with the asbestos requirements when:

- The individual material in question contains more than 1% asbestos (by weight)
- The material contains less than 1% asbestos, but it is known that a restricted area is likely to occur when it is disturbed (e.g., vermiculite)
- The material contains less than 1% asbestos and there is a reasonable chance that asbestos fibres may be released when the material is disturbed, either due to the condition of the material or the work procedures that will be used (e.g., removal of friable stipple material, dry removal of wall and ceiling plaster, or drywall where the materials contain low levels of asbestos)

The *Alberta Asbestos Abatement Manual* (Government of Alberta, 2012) describes the asbestos assessment requirements, management of asbestos on-site, abatement operations, and procedures (i.e., Type 1, 2, and 3), the use of personal protective equipment, and air monitoring requirements.

The disposal of asbestos is regulated by the Province of Alberta *Environmental Protection and Enhancement Act* (Province of Alberta, amended 2013) and *Guidelines for the Disposal of Asbestos Waste* (Alberta Environment, 1989).

2.2 LEAD

Lead may be present in paint, solder used on copper pipes, caulking on cast iron water pipes, glazing on ceramic tiles, and electrical wires and fixtures. Workers and building occupants may be exposed during demolition/renovation activities. Primary routes of exposure include inhalation, absorption through the skin, and ingestion. Over exposure can affect the blood, kidneys, gastro-intestinal system, nervous system, and reproductive system (Government of Alberta, 2013).

The *Surface Coatings Materials Regulations* (Government of Canada, 2016) limits the total lead concentration in surface coating materials to 90 mg/kg under Subsection 2(1). Therefore, using this threshold limit, surface coating

materials with lead concentrations that exceed 90 mg/kg (0.009% by weight) are considered to be lead-containing according to the *Surface Coatings Materials Regulations*.

3 SURVEY METHODOLOGY

Bulk samples were collected only from suspected asbestos-containing building materials and lead-containing paints (e.g., paint chips) within the proposed work area.

3.1 ASBESTOS

The surveyor inspected the subject areas for the presence of friable and non-friable ACMs including, but not limited to:

- Cement paste
- Insulation
- Joint tape compound

Bulk samples were collected from these materials and analyzed to confirm the presence/absence of asbestos.

The bulk material sample collection methodology for this survey was based on the methodology outlined in the *Alberta Asbestos Abatement Manual* (Government of Alberta, 2012) as it specifically outlines the minimum number of bulk material samples to be collected for various types of materials and is also consistent with industry standards. Table 1 outlines these bulk sample requirements.

Table 1 - Minimum Number of Bulk Samples to be Collected Under the Alberta Asbestos Abatement Manual

TYPE OF MATERIAL	SIZE OF HOMOGENOUS MATERIAL	MINIMUM NUMBER OF BULK SAMPLES
Any homogenous material, including but not limited to fireproofing, drywall joint compound, ceiling tile, stucco, acoustical, and stipple finished and visually similar floor tiles.	Less than 90 m^2	3
	Between 90 and 450 m^2	5
	450 m^2 or more	7

A summary of the bulk samples collected from the building, including a description of the material, sampling location, type of analysis, and laboratory test results is provided in Section 4.

Sample locations were left in a safe condition. The following procedures for collection of bulk samples were followed:

- The surface of the material was wetted with amended water using a spray bottle. In situations where the material could not be wetted, a plastic sample bag or other containment device was placed around the sampling device.
- A sample was obtained by one of two methods:
  - A sharp sampling device was slowly pushed into the material with a twisting motion until the entire thickness was penetrated, followed by extraction of the sample.

  - A knife was cleaned and then used to excise a piece of the material.
- Each sample was placed in a clear bag with a tight closure, labelled appropriately, and placed in a second, similar bag.
- Debris was cleaned with wet paper towels and discarded into a plastic bag.
- A chain of custody form was completed for samples collected on-site and accompanied the samples during shipment to an independent laboratory for analysis.

Bulk samples from suspect building/construction materials were collected and submitted to EMSL Analytical, Inc. (EMSL) in Calgary, Alberta, for analysis using polarized light microscopy. The analysis was conducted following the U.S. EPA/600/R-93/116 Methods.

3.2 LEAD

Bulk paint samples (paint chips) from distinct colors observed outside and inside of the buildings were collected during the survey and submitted for analysis of lead content. Samples were collected with the aid of a thin-bladed knife which was cleaned prior to each sampling event. The site surveyor selected sample locations where it appeared that the paint application was most representative of areas on which it was applied. Each paint chip sample was placed in a clear bag with a tight closure, labelled appropriately, and placed in a second, similar bag. A chain of custody form was completed for all samples collected on-site and accompanied the samples during shipment to an independent laboratory for analysis.

To determine their lead content, samples were submitted to EMSL in Calgary, Alberta and analyzed by Flame AAS SW 846 3050B/7000B Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry.

A summary of the bulk paint samples collected, including a sample description, sampling location, type of analysis, and laboratory test results is provided in Section 4.

4 OBSERVATIONS AND RESULTS

Hazardous materials identified during this survey along with the analytical results from samples obtained are detailed below. Sample locations and relevant photographs (Infield Report), can be found in Appendix A. Laboratory Certificates of Analysis are provided in Appendix B.

4.1 ASBESTOS-CONTAINING MATERIALS

A total of 14 bulk material samples were collected from homogeneous materials observed within the proposed work areas.

Friable ACM was identified in the beige cement paste present on flanged connections, around valves, and pipe elbows in the fire pump room and at flanged connections in the tank room.

Table 2 below provides a summary of the materials sampled and identified as asbestos and non-asbestos during the survey.

Table 2 - Summary of Asbestos Results

MATERIAL	LOCATION	DESCRIPTION	SAMPLE ID[1]	ASBESTOS CONTENT/TYPE
Joint Tape Compound	Around valves/pipe elbows and flanged connections	Silver/beige	12, 13, 23	None Detected
Cement Paste	Fire Pump Equipment (flanged connection/around valves/pipe elbow)	Beige	14, 22	**15% to 40% Chrysotile**
	Fire Pump Equipment (flanged connection/around valves/pipe elbows)	Beige Silver/yellow	15, 18, 21, 27, 30	None Detected
	Tank Room (at flanged connection)	Beige	31	**15% Chrysotile**
Insulation	Pipe	Yellow	16, 9, 20	None Detected

[1] For Sample ID and concentration levels refer to Appendix B – Laboratory Certificates of Analysis

**** Asbestos Detected***

WSP did not observe the asbestos-containing cement paste on pipe straight runs within the proposed work area, where was possible to observe.

The following areas are considered not accessible to the surveyor and as such materials suspected to contain asbestos may be present within these inaccessible areas, including:

- Electrical wiring insulation and conductors,
- Underground utilities and piping,
- Packing materials in valves, fittings, etc., may be present but are inaccessible without demolition activities (e.g. within concealed areas behind bulkheads).

Prior to disturbance, these areas should be inspected and/or sampled for presence or absence of asbestos.

4.2 LEAD

A total of 7 paint chip samples from distinct paint colours observed within the proposed work area were collected and submitted for analysis of lead content. A total of 6 out of 7 analyzed samples were identified as lead-based paints (LBPs). Some LBPs (silver and yellow) were delaminating from the surfaces they were applied to (hot pipes).

At the time of the survey, additional paint colours could not be sampled due to a limited quantity or difficulty to remove the paint from the surfaces (black and blue on valves and connections). These paints should be considered lead-based unless proven otherwise.

Table 3 summarizes the lead-containing paint identified during the survey.

Table 3 - Summary of Lead Paint Sample Concentrations

MATERIAL	LOCATION	ASSESSMENT[1]
Red paint	Pump	Sample ID: 1 **Concentration: 21,000 ppm**
Grey paint	On concrete pad under the pump	Sample ID: 2 **Concentration: 1,500 ppm**
Dark green paint	Valves	Sample ID: 3 **Concentration: 25,000 ppm**
Light blue paint	Valve connections	Sample ID: 4 **Concentration: 2,100 ppm**
Bright green paint	Valves	Sample ID: 5 Concentration: <87 ppm
Silver paint	Pipe	Sample ID: 7 **Concentration: 75,000 ppm**
Yellow paint	Pipe	Sample ID: 8 **Concentration: 35,000 ppm**

[1] For Sample ID and concentration levels refer to Appendix B – Laboratory Certificates of Analysis
*** Lead-based paint**

Additionally, lead-containing solder on pipe joints is suspected to be present on piping.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 ASBESTOS

Friable ACM was identified in the beige cement paste present on flanged connections, around valves, and pipe elbows in the fire pump room and at flanged connections in the tank room at the proposed work area. Although some of the beige/silver/yellow cement paste samples were not considered asbestos-containing, it should be assumed all cement paste within the work area is asbestos-containing as all cement paste was visually similar and some samples tested positive for asbestos. Joint tape compound and fiberglass insulation around the cement paste were identified as non-ACM. To avoid the release of asbestos fibres, these materials should be removed as asbestos-containing as the removal will likely expose the friable cement paste material.

Asbestos abatement measures are required prior to any equipment replacement activities at the Site. Under the requirements in Section 34 of the OHS Code, all building materials with the potential to release asbestos fibers must be removed prior to being disturbed during the renovation activities. The Government of Alberta 2012 publication *Alberta Asbestos Abatement Manual* describes acceptable practices.

Cement paste must be removed from the pipe elbows, around valves and flanged connections from those sections that are to be replaced. Specifications for a Glovebag removal technique are present in Appendix C. Joint tape compound and insulation will have to be removed and disposed with the asbestos-containing cement paste.

Asbestos-containing cement paste on pipes that are not to be disturbed during the repair work and is in good condition can remain onsite. Asbestos-containing cement paste on pipes that are to be left in place should be labelled as “asbestos”. An Asbestos Management Plan should be developed and implemented to ensure adequate handling of ACMs during maintenance operations. Any damaged asbestos-containing cement paste material should be the removed or encapsulation to comply with the regulations.

Any other materials encountered renovations that were not identified and sampled as part of this survey should be presumed to contain asbestos unless proven otherwise by additional sampling and testing.

Retain a copy of this report and provide it to any contractors who may be undertaking repair/replacement work of the piping as required by the *Alberta Occupational Health and Safety Act* (Alberta Queen’s Printer, 2018).

5.2 LEAD

A total of 6 out of 7 analyzed samples were identified as LBPs. Some LBPs (silver and yellow) were delaminating from the surfaces they were applied to. Lead-containing paints in good condition may stay in place. Otherwise, all delaminating or damaged lead-containing paints should be removed or encapsulated with a non-lead-containing paint.

Proper procedures and documentation such as safe work practices, an exposure control plan, risk assessments, and/or other controls must be developed for all workers if lead-containing paint is to be removed from the surfaces, if the substrate is to be cut or ground using abrasive methods or if otherwise disturbed.

Lead-containing paints delaminating from their substrates must be submitted for lead leachate analysis to determine the appropriated method of disposal. Other lead painted materials may be disposed of at a Class 2 landfill without additional testing.

Lead-containing solder on pipe joints (if present) removed during the pipes replacement should be properly recycled.

6 LIMITATIONS

This report describes the ACMs and lead paint materials observed by the surveyor(s) at the subject property. The survey assessed only those structures, finishes, permanent fixtures and components identified in this report. The assessment does not consider or define contaminants that may be present in the soil or in the air.

The field observations and laboratory analyses presented herein are considered sufficient in detail and scope to form a general inventory of hazardous materials at the subject building(s) and/or property. The findings and conclusions contained herein have been prepared in accordance with generally accepted industry standards and procedures. It is possible that hazardous materials may exist which could not be reasonably identified within the scope of the assessment or which were not apparent during the site visit. WSP cannot warrant or guarantee that the information presented in this report is absolutely complete or accurate beyond those observations and findings reported herein.

7 REFERENCES

- Alberta Environment (1989). *Guidelines for the Disposal of Asbestos Waste.*
- Alberta Queens Printer, Occupational Health and Safety Regulation (2018), https://work.alberta.ca/occupational-health-safety/ohs-act-regulation-and-code.html
- Government of Alberta (2012). *Alberta Asbestos Abatement Manual*, Employment and Immigration. Available online at: https://work.alberta.ca/documents/Asbestos-Abatement-Manual.pdf
- Government of Alberta (2013). Occupational Health and Safety Bulletin, Lead at the Work Site (2013). Employment and Immigration.
- Government of Canada (2016). Canadian Consumer Product Safety Act, Surface Coatings Materials Regulations (Lead), SOR/2016-193. Available online at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2016-193/index.html

APPENDIX

A INFIELD REPORT

Drumheller Institution, Drumheller, Alberta

Asbestos and Lead Sampling

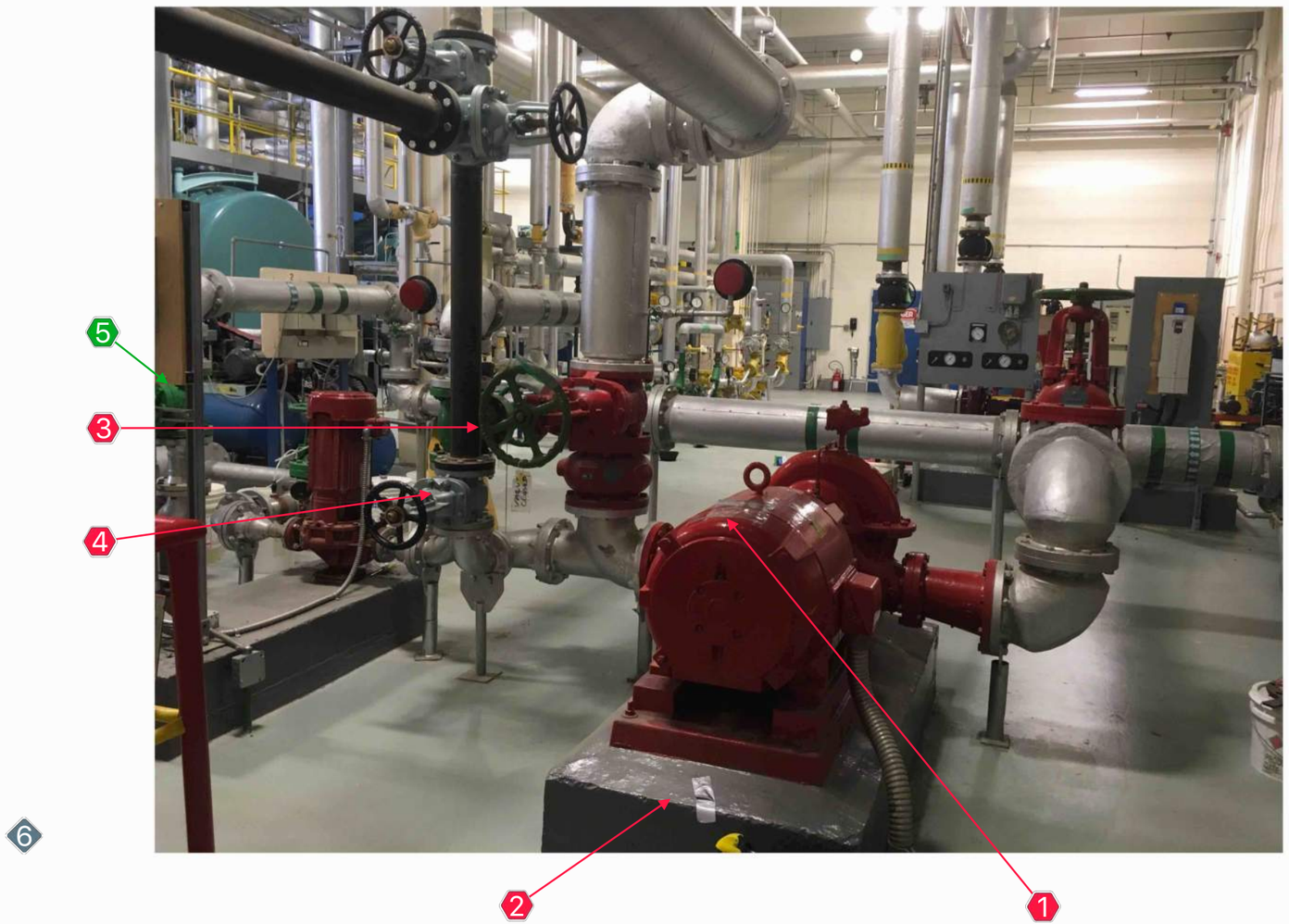
Public Works and Government Services Canada

Fire Pump Replacement

Field Report
Project No. 181-01555-00
Date: April 6, 2018
Prepared by: Daria Klimenko

WSP Canada Inc.
237 - 4 Avenue SW, Suite 3300
Calgary (Alberta) T2P 4K3 Canada
+1 403-271-4442
www.wsp.com

FIRE PUMP EQUIPMENT WEST SECTION_LEAD SAMPLING



LEGEND

SHAPES

- General
- Lead sample (paint)

COLORS

- Lead containing paint
- Sample under regulatory limit

FIRE PUMP EQUIPMENT WEST SECTION_LEAD SAMPLING

1 Pump — Daria.Klimenko - 2018-04-06 11:30

Lead sample (paint) — Mecanical — Red paint on metal — Current study sample/obs — Lead containing paint

Red paint on other fittings of the fire system — Comment - Daria.Klimenko - 2018-04-06 11:32

2 Pump Concrete Pad — Daria.Klimenko - 2018-04-06 11:33

Lead sample (paint) — Wall/Column — Grey paint on concrete — Current study sample/obs — Lead containing paint

3 Valve — Daria.Klimenko - 2018-04-06 11:35

Lead sample (paint) — Mecanical — Dark green paint on metal — Current study sample/obs — Lead containing paint

4 Connection — Daria.Klimenko - 2018-04-06 11:37

Lead sample (paint) — Mecanical — Light blue paint on metal — Current study sample/obs — Lead containing paint

5 Valve — Daria.Klimenko - 2018-04-06 11:39

Lead sample (paint) — Mecanical — Bright green paint on metal — Current study sample/obs — Sample under regulatory limit

6 Lead Observations — Daria.Klimenko - 2018-04-06 11:41

General — Current study sample/obs

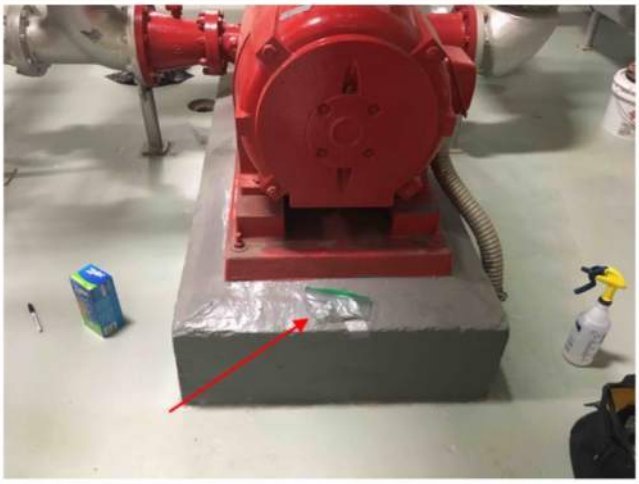
Red, dark and bright green, silver, light blue, grey, black, dark blue, yellow. Black and dark blue paints were not sampled due to good condition and limited quantity — Comment - Daria.Klimenko - 2018-04-06 11:43

FIRE PUMP EQUIPMENT WEST SECTION_LEAD SAMPLING

1 **Pump**
Lead sample (paint) — Mecanical — Red paint on metal — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-07 00:05

1 **Pump**
Lead sample (paint) — Mecanical — Red paint on metal — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-06 11:31

1 **Pump**
Lead sample (paint) — Mecanical — Red paint on metal — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-06 11:31



2 **Pump Concrete Pad**
Lead sample (paint) — Wall/Column — Grey paint on concrete — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-06 11:34

3 **Valve**
Lead sample (paint) — Mecanical — Dark green paint on metal — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-06 11:36

4 **Connection**
Lead sample (paint) — Mecanical — Light blue paint on metal — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-06 11:38

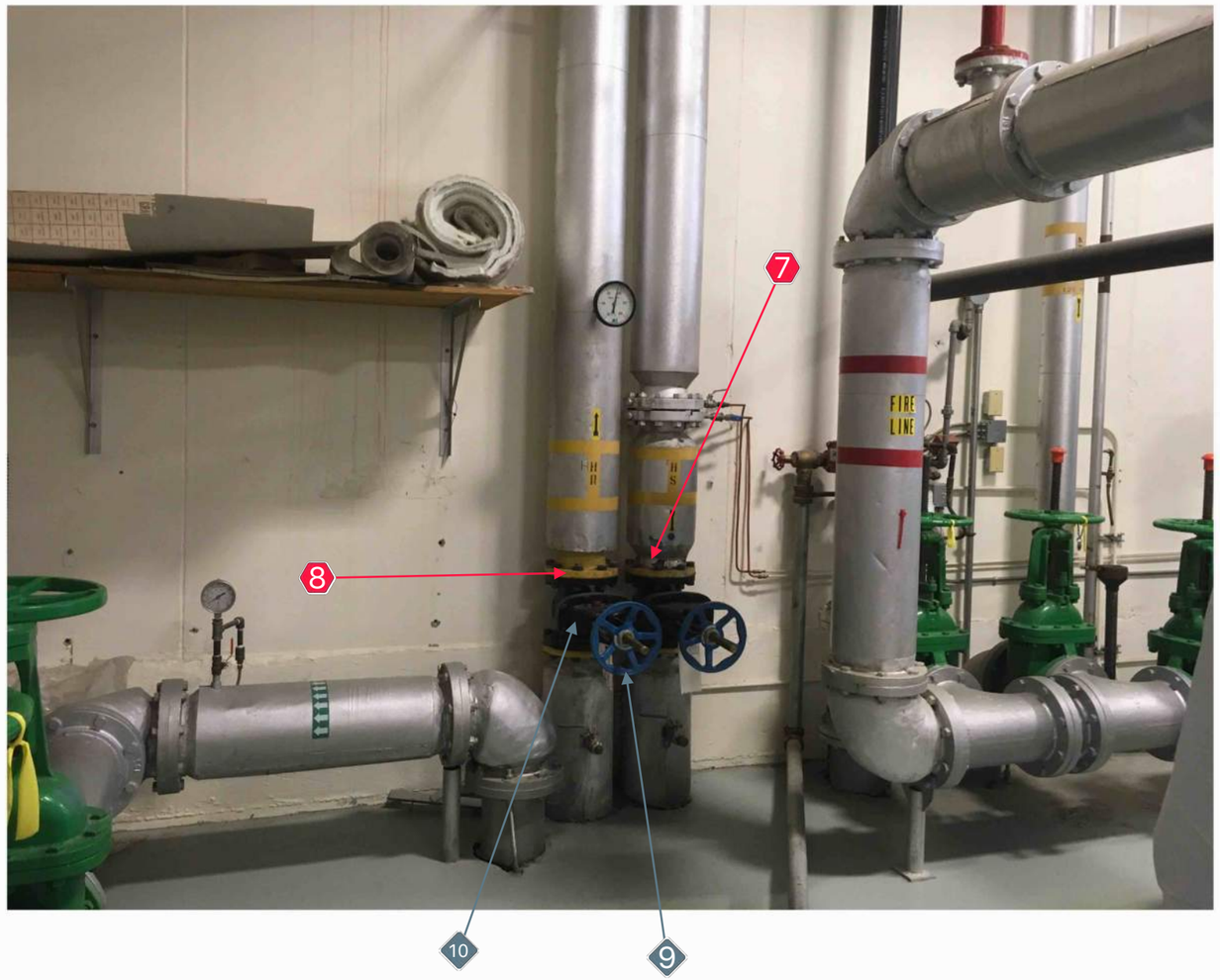
FIRE PUMP EQUIPMENT WEST SECTION_LEAD SAMPLING

5 **Valve**
Lead sample (paint) — Mecanical — Bright green paint on metal — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 11:39

5 **Valve**
Lead sample (paint) — Mecanical — Bright green paint on metal — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 11:39

6 **Lead Observations**
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 11:42

FIRE PUMP EQUIPMENT EAST SECTION_LEAD SAMPLING



LEGEND

SHAPES

- General
- Lead sample (paint)

COLORS

- Lead containing paint

FIRE PUMP EQUIPMENT EAST SECTION_LEAD SAMPLING

7 Pipe — Daria.Klimenko - 2018-04-06 11:45
Lead sample (paint) — Pipe — Silver paint on metal — Current study sample/obs — Lead containing paint

8 Pipe — Daria.Klimenko - 2018-04-06 11:47
Lead sample (paint) — Pipe — Yellow paint on metal — Current study sample/obs — Lead containing paint

9 Valves — Daria.Klimenko - 2018-04-06 15:14
General — Current study sample/obs

Dark blue paint on valves — Comment - Daria.Klimenko - 2018-04-06 15:14

10 Valves — Daria.Klimenko - 2018-04-06 15:14
General — Current study sample/obs

Black paint on pipe — Comment - Daria.Klimenko - 2018-04-06 15:15

FIRE PUMP EQUIPMENT EAST SECTION_LEAD SAMPLING

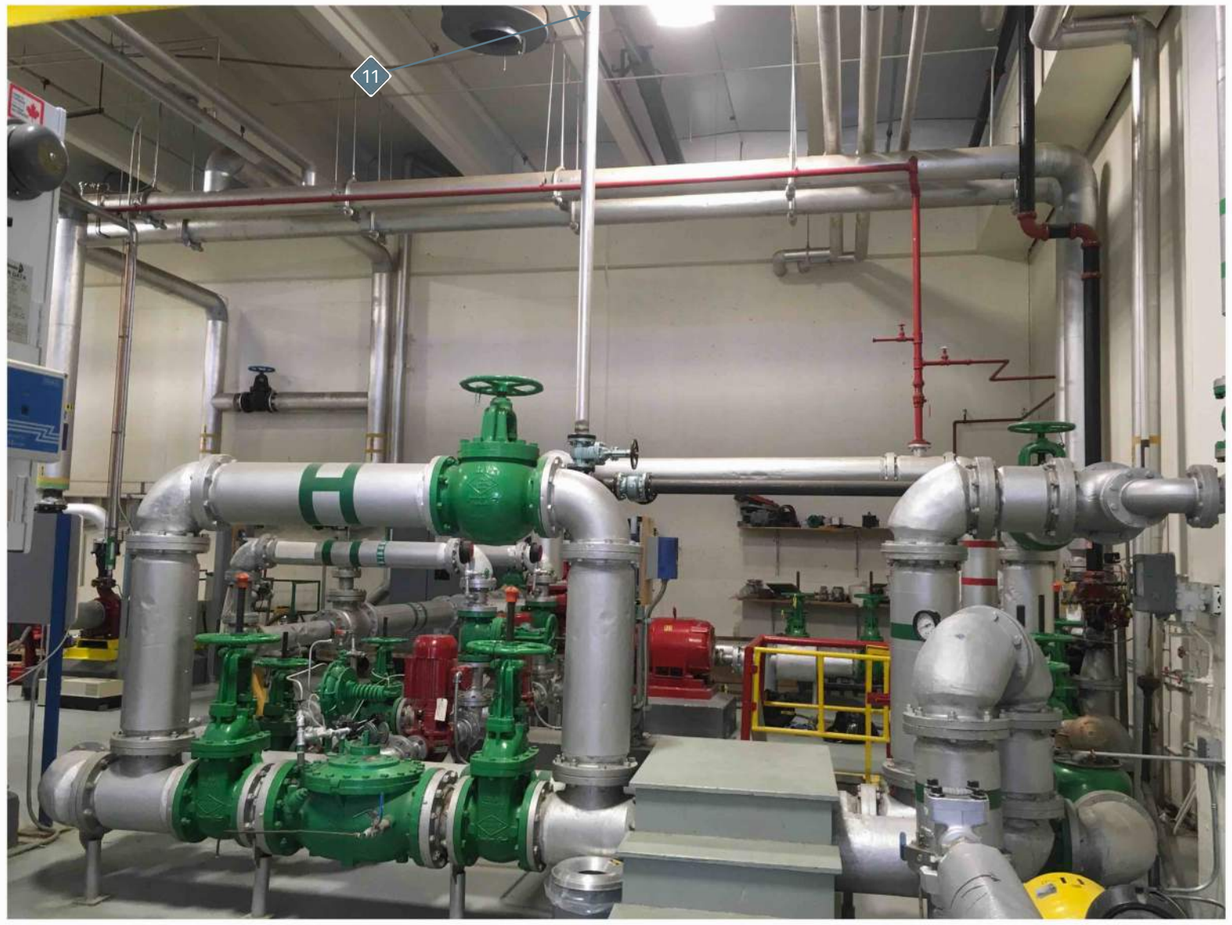
7 **Pipe**
Lead sample (paint) — Pipe — Silver paint on metal — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-06 11:46

8 **Pipe**
Lead sample (paint) — Pipe — Yellow paint on metal — Current study sample/obs — Lead containing paint
Daria.Klimenko - 2018-04-06 11:47

9 **Valves**
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 15:20

10 **Valves**
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 15:19

FIRE PUMP AREA LOOKING NORTH



LEGEND

SHAPES

◆ General

FIRE PUMP AREA LOOKING NORTH

11 Piping
General — Current study sample/obs

Daria.Klimenko - 2018-04-06 11:55

Cannot sample as cannot access with a ladder or lift

Comment - Daria.Klimenko - 2018-04-06 11:56

FIRE PUMP AREA LOOKING NORTH

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:54

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 14:10

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:44

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:54

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:44

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:54

FIRE PUMP AREA LOOKING NORTH

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:45

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 11:55

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:54

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:54

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 14:11

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:54

FIRE PUMP AREA LOOKING NORTH

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:54

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:44

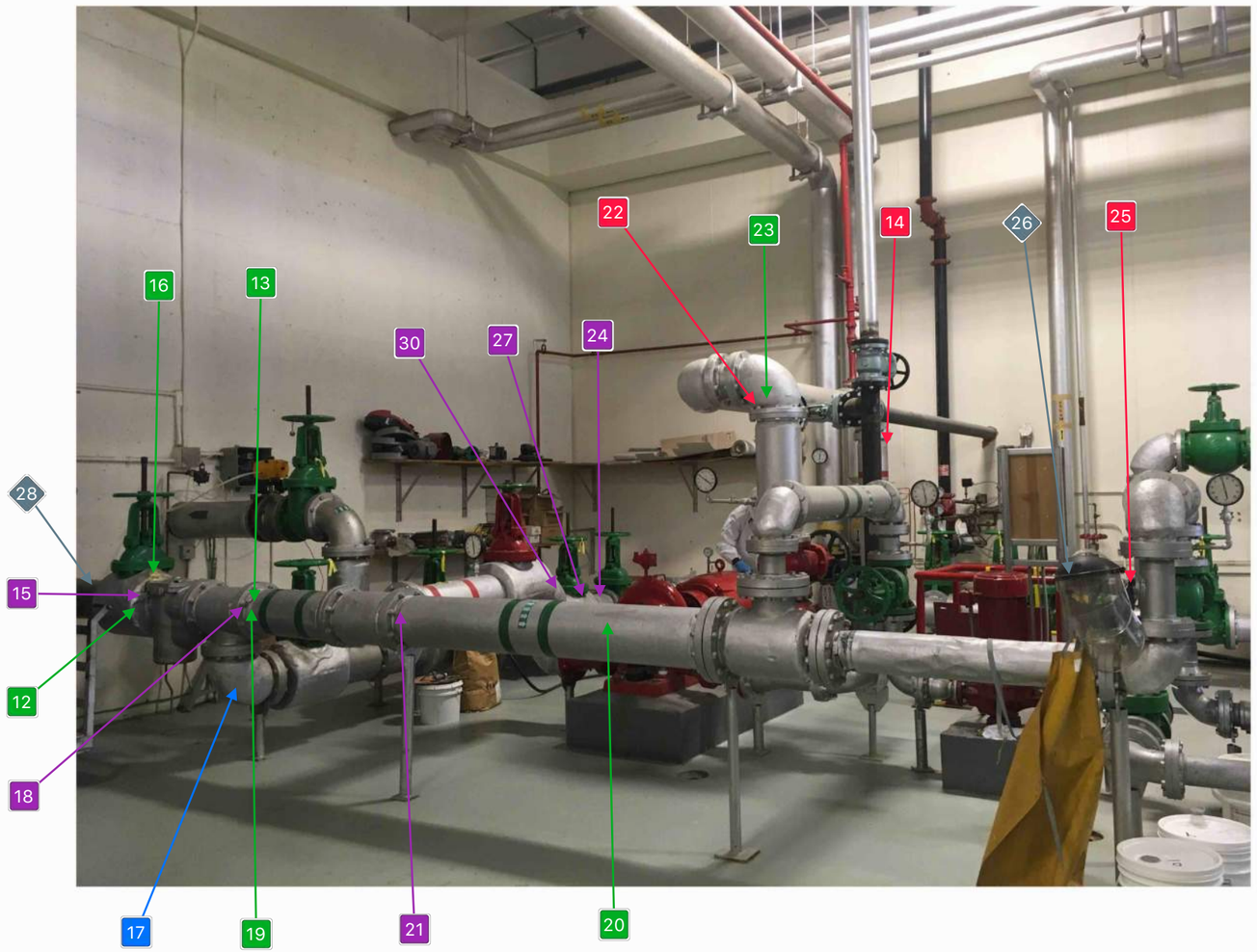
11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 14:11

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 14:10

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:44

11 Piping
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:45

FIRE PUMP EQUIPMENT NORTH_ASBESTOS TESTING



LEGEND

SHAPES

- Asbestos sample (MSCA)
- General

COLORS

- ACM
- ACM presumed
- Observation
- Sample under regulatory limit

FIRE PUMP EQUIPMENT NORTH_ASBESTOS TESTING

12 Pipe — Daria.Klimenko - 2018-04-06 12:00
Asbestos sample (MSCA) — Pipe — Joint tape compound — At elbows and flanged connection — Accessible / Visible — Fair — Current study sample/obs — Sample under regulatory limit

13 Pipe — Daria.Klimenko - 2018-04-06 12:01
Asbestos sample (MSCA) — Pipe — Joint tape compound — At elbows and flanged connection — Accessible / Visible — Poor — Current study sample/obs — Sample under regulatory limit

14 Pipe — Daria.Klimenko - 2018-04-06 12:03
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — At elbows and flanged connection — Accessible / Visible — Fair — Current study sample/obs — ACM

15 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

16 Pipe — Daria.Klimenko - 2018-04-06 12:23
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Sample under regulatory limit

17 Pipe — Daria.Klimenko - 2018-04-06 12:23
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Observation

18 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

19 Pipe — Daria.Klimenko - 2018-04-06 12:23
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Sample under regulatory limit

20 Pipe — Daria.Klimenko - 2018-04-06 12:52
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Sample under regulatory limit

21 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

22 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — Elbow — Cement paste — Elbows and piping — Inaccessible / Not visible — Fair — Current study sample/obs — ACM

23 Pipe — Daria.Klimenko - 2018-04-06 12:01
Asbestos sample (MSCA) — Pipe — Elbow — Joint tape compound — At elbows and flanged connection — Accessible / Visible — Fair — Current study sample/obs — Sample under regulatory limit

24 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and piping — Inaccessible / Not visible — Fair — Current study sample/obs — ACM presumed

25 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Fair — Current study sample/obs — ACM

26 Pipe — Daria.Klimenko - 2018-04-06 13:17
General — Current study sample/obs

Metal pipe — Comment - Daria.Klimenko - 2018-04-06 13:18

27 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

28 Pipe — Daria.Klimenko - 2018-04-06 13:32
General — Current study sample/obs

The same insulation and taping compound — Comment - Daria.Klimenko - 2018-04-06 13:33

30 Pipe — Daria.Klimenko - 2018-04-06 12:22
Asbestos sample (MSCA) — Pipe — Pump — Cement paste — Elbows and piping — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

FIRE PUMP EQUIPMENT NORTH_ASBESTOS TESTING

12 Pipe
Asbestos sample (MSCA) — Pipe — Joint tape compound — At elbows and flanged connection — Accessible / Visible — Fair — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 12:01

13 Pipe
Asbestos sample (MSCA) — Pipe — Joint tape compound — At elbows and flanged connection — Accessible / Visible — Poor — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 12:01

14 Pipe
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — At elbows and flanged connection — Accessible / Visible — Fair — Current study sample/obs — ACM
Daria.Klimenko - 2018-04-06 12:04

15 Pipe
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed
Daria.Klimenko - 2018-04-06 12:23

16 Pipe
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 12:24

17 Pipe
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Observation
Daria.Klimenko - 2018-05-18 14:09

FIRE PUMP EQUIPMENT NORTH_ASBESTOS TESTING

18 Pipe
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed
Daria.Klimenko - 2018-04-06 12:40

19 Pipe
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 12:40

20 Pipe
Asbestos sample (MSCA) — Pipe — Pipe insulation — On other pipes — Inaccessible / Not visible — Fair — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 12:52

21 Pipe
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed
Daria.Klimenko - 2018-04-06 12:59

22 Pipe
Asbestos sample (MSCA) — Pipe — Elbow — Cement paste — Elbows and piping — Inaccessible / Not visible — Fair — Current study sample/obs — ACM
Daria.Klimenko - 2018-04-06 13:00

23 Pipe
Asbestos sample (MSCA) — Pipe — Elbow — Joint tape compound — At elbows and flanged connection — Accessible / Visible — Fair — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 13:05

FIRE PUMP EQUIPMENT NORTH_ASBESTOS TESTING

23 **Pipe**
Asbestos sample (MSCA) — Pipe — Elbow — Joint tape compound — At elbows and flanged connection — Accessible / Visible — Fair — Current study sample/obs — Sample under regulatory limit
Daria.Klimenko - 2018-04-06 13:05

24 **Pipe**
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and piping — Inaccessible / Not visible — Fair — Current study sample/obs — ACM presumed
Daria.Klimenko - 2018-04-06 13:09

25 **Pipe**
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Fair — Current study sample/obs — ACM
Daria.Klimenko - 2018-04-06 13:17

26 **Pipe**
General — Current study sample/obs
Daria.Klimenko - 2018-04-06 13:18

27 **Pipe**
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed
Daria.Klimenko - 2018-04-06 13:29

27 **Pipe**
Asbestos sample (MSCA) — Pipe — At flanged connection — Cement paste — Elbows and flanged connection — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed
Daria.Klimenko - 2018-04-06 13:29

FIRE PUMP EQUIPMENT NORTH_ASBESTOS TESTING

28 **Pipe**

General — Current study sample/obs

Daria.Klimenko - 2018-04-06 13:32

30 **Pipe**

Asbestos sample (MSCA) — Pipe — Pump — Cement paste — Elbows and piping — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

Daria.Klimenko - 2018-04-06 13:46

30 **Pipe**

Asbestos sample (MSCA) — Pipe — Pump — Cement paste — Elbows and piping — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

Daria.Klimenko - 2018-04-06 13:46

30 **Pipe**

Asbestos sample (MSCA) — Pipe — Pump — Cement paste — Elbows and piping — Inaccessible / Not visible — Poor — Current study sample/obs — ACM presumed

Daria.Klimenko - 2018-04-06 13:46

TANK ROOM_ASBESTOS TESTING

LEGEND

SHAPES

- Asbestos sample (MSCA)

COLORS

- ACM

TANK ROOM_ASBESTOS TESTING

31 Pipe

Daria.Klimenko - 2018-04-06 14:02

Asbestos sample (MSCA) — Pipe — Beige at flanged connection — Cement paste — At flanged connection — Inaccessible / Not visible — Fair — Current study sample/obs — ACM

TANK ROOM_ASBESTOS TESTING

31 **Pipe**
Asbestos sample (MSCA) — Pipe — Beige at flanged connection — Cement paste — At flanged connection — Inaccessible / Not visible — Fair — Current study sample/obs — ACM
Daria.Klimenko - 2018-04-06 14:04

31 **Pipe**
Asbestos sample (MSCA) — Pipe — Beige at flanged connection — Cement paste — At flanged connection — Inaccessible / Not visible — Fair — Current study sample/obs — ACM
Daria.Klimenko - 2018-04-06 14:03

31 **Pipe**
Asbestos sample (MSCA) — Pipe — Beige at flanged connection — Cement paste — At flanged connection — Inaccessible / Not visible — Fair — Current study sample/obs — ACM
Daria.Klimenko - 2018-04-06 14:04

APPENDIX

B LABORATORY CERTIFICATES OF ANALYSIS

EMSL Canada Inc.

2333 18th Avenue NE, Unit 48 Calgary, AB T2E 8T6
Phone/Fax: (403) 879-1149 / (403) 879-1152
http://www.EMSL.com / CalgaryLab@EMSL.com

EMSL Canada Order 651803203
Customer ID: 55WSPA42
Customer PO:
Project ID:

Attn: Daria Klimenko
WSP Canada Inc.
237-4 Avenue SW
Suite 3300 Fifth Avenue Place
Calgary, AB T2P 4K3

Phone: (403) 389-8732
Fax:
Collected: 4/ 6/2018
Received: 4/11/2018
Analyzed: 4/18/2018

Proj: HAZMAT SURVEY / 181 - 01555 - 00 / DRUMHELLER INSTITUTIONAL CENTRAL HEATING PLANT

Test Report: Asbestos Analysis of Bulk Materials for OHS Alberta Abatement Manual via EPA600/R-93/116 Method

Client Sample ID: 12 ***Lab Sample ID:*** **651803203-0001**
Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE/JOINT TAPE COMPOUND

TEST	Analyzed Date	Color	Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Silver/Beige	45%	55%	None Detected	

Client Sample ID: 13 ***Lab Sample ID:*** **651803203-0002**
Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE/JOINT TAPE COMPOUND

TEST	Analyzed Date	Color	Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Silver/Beige	45%	55%	None Detected	

Client Sample ID: 23 ***Lab Sample ID:*** **651803203-0003**
Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - ELBOW/JOINT TAPE COMPOUND

TEST	Analyzed Date	Color	Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Silver/Beige	60%	40%	None Detected	

Client Sample ID: 14 ***Lab Sample ID:*** **651803203-0004**
Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	0%	60%	**40% Chrysotile**	

Client Sample ID: 15 ***Lab Sample ID:*** **651803203-0005**
Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	25%	75%	None Detected	

Client Sample ID: 18 ***Lab Sample ID:*** **651803203-0006**
Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	30%	70%	None Detected	

Client Sample ID: 21 ***Lab Sample ID:*** **651803203-0007**
Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	30%	70%	None Detected	

EMSL Canada Inc.

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Phone/Fax: (403) 879-1149 / (403) 879-1152
http://www.EMSL.com / CalgaryLab@EMSL.com

EMSL Canada Order 651803203
Customer ID: 55WSPA42
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for OHS Alberta Abatement Manual via EPA600/R-93/116 Method

Client Sample ID: 22 ***Lab Sample ID:*** **651803203-0008**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - ELBOW/CEMENT PASTE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	0%	60%	**40% Chrysotile**	

Client Sample ID: 24 ***Lab Sample ID:*** **651803203-0009**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Silver/Yellow	80%	20%	None Detected	

Client Sample ID: 25 ***Lab Sample ID:*** **651803203-0010**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	0%	85%	**15% Chrysotile**	

Client Sample ID: 27 ***Lab Sample ID:*** **651803203-0011**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	30%	70%	None Detected	

Client Sample ID: 30 ***Lab Sample ID:*** **651803203-0012**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE - PUMP/CEMENT PASTE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	30%	70%	None Detected	

Client Sample ID: 16 ***Lab Sample ID:*** **651803203-0013**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Yellow	95%	5%	None Detected	

Client Sample ID: 19 ***Lab Sample ID:*** **651803203-0014**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Yellow	95%	5%	None Detected	

Client Sample ID: 20 ***Lab Sample ID:*** **651803203-0015**

Sample Description: FIRE PUMP EQUIPMENT NORTH - PIPE/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Yellow	95%	5%	None Detected	

EMSL Canada Inc.

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http://www.EMSL.com / CalgaryLab@EMSL.com

EMSL Canada Order 651803203
Customer ID: 55WSPA42
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for OHS Alberta Abatement Manual via EPA600/R-93/116 Method

Client Sample ID: 31 ***Lab Sample ID:*** **651803203-0016**

Sample Description: TANK ROOM - PIPE - AT FLANGED CONNECTION/CEMENT PASTE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	4/18/2018	Beige	0%	85%	**15% Chrysotile**	

Analyst(s):

Leanne Roy PLM (16)

Reviewed and approved by:

Jefferson Salvador, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Calgary, AB

Initial report from: 04/18/201810:50:35

OrderID: 651803203

EMSL CANADA, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*: 651803203

EMSL CANADA, INC.
UNIT 48, 2333 18 AVE NE
CALGARY, AB T2E 8T6
PHONE: (403) 879-1149
FAX: (403) 879-1152

Company : WSP Canada Inc.	EMSL-Bill to: ☒ Same ☐ Different If Bill to is Different note instructions in Comments**
Street: 237 - 4 Avenue SW, Suite 3300	*Third Party Billing requires written authorization from third party*
City: Calgary / State/Province: AB	Zip/Postal Code: T2P 4K3 / Country: Canada
Report To (Name): Daria Klimenko	Fax #:
Telephone #: 403-389-8732	Email Address: daria.klimenko@wsp.com
Project Name/Number: Hazmat Survey/181-01555-00/ Drumheller Institutional Central Heating Plant	
Please Provide Results: ☐ Fax ☒ Email / Purchase Order:	Province/Territory Sample Taken: AB

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

**For TEM Air 3 hours through 6 hours, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ IRSST 244 PLM
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT** (AHERA only)
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ IRSST 244 TEM (NYS 198.4)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2

Fibers >10µm ☐ Waste ☐ Drinking
All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ ASTM D7521 Sieve Method
- ☐ PLM EPA 600/R-93/116 with milling prep(<0.25%)
- ☐ TEM EPA 600/R-93/116 with milling prep (<0.01%)
- ☐ TEM Qualitative via Filtration Prep
- ☐ TEM Qualitative via Drop Mount Prep
- ☐ Cincinnati Method EPA 600/R-04/004 - PLM/TEM (BC and NS)

Other:
- ☐

☒ **Check For Positive Stop – Clearly Identify Homogenous Group** ↳ see excel

Filter Pore Size (Air Samples): ☐ 0.8µm ☐ 0.45µm

Samplers Name: Daria K./Marcus **Samplers Signature:**

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
	see excel list sent via email		

Client Sample # (s): - **Total # of Samples:** 16

Relinquished (Client): Daria Klimenko **Date:** April 10, 2018 **Time:** 10 am

Received (Lab): 04-11-18 12:25 RCVD **Date:** Courier STL **Time:**

Comments/Special Instructions: Please notify me if any samples will have to be analyzed by point count

651803203

Issue ID	Area	Location	Material detail	Material description	Date	Positive stop
12	Fire Pump Equipment North_	{Pipe}	N.A.	{Joint tape compound}	2018-04-06	1
13	Fire Pump Equipment North_	{Pipe}	N.A.	{Joint tape compound}	2018-04-06	1
23	Fire Pump Equipment North_	{Pipe}	{Elbow}	{Joint tape compound}	2018-04-06	1
14	Fire Pump Equipment North_	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	
15	Fire Pump Equipment North_	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	
18	Fire Pump Equipment North_	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	
21	Fire Pump Equipment North_	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	
22	Fire Pump Equipment North_	{Pipe}	{Elbow}	Cement paste	2018-04-06	
24	Fire Pump Equipment North_	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	
25	Fire Pump Equipment North_	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	
27	Fire Pump Equipment North_	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	
30	Fire Pump Equipment North_	{Pipe}	Pump	Cement paste	2018-04-06	
16	Fire Pump Equipment North_	{Pipe}		{Pipe insulation}	2018-04-06	2
19	Fire Pump Equipment North_	{Pipe}		{Pipe insulation}	2018-04-06	2
20	Fire Pump Equipment North_	{Pipe}		{Pipe insulation}	2018-04-06	2
31	Tank Room	{Pipe}	{At flanged connection}	Cement paste	2018-04-06	

EMSL Canada Inc.
2756 Slough Street, Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com torontolab@emsl.com

EMSL Canada Or	551804039
CustomerID:	55WSPA42
CustomerPO:	181-01555-00
ProjectID:	

Attn: **Daria Klimenko**
WSP Canada Inc.
237-4 Avenue SW
Suite 3300 Fifth Avenue Place
Calgary, AB T2P 4K3

Phone: (403) 389-8732
Fax:
Received: 04/12/18 11:11 AM
Collected: 4/6/2018

Project: **HAZMAT SURVEY // 181-01555-00 DRUMHELLER INSTITUTIONAL CENTRAL HEATING PLANT**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
1	*551804039-0001*	4/6/2018	4/13/2018	0.2350 g	21000 ppm
	Site: FIRE PUMP EQUIPMENT WEST SECTION - (PUMP) - MECHANICAL - RED PAINT ON METAL				
2	*551804039-0002*	4/6/2018	4/13/2018	0.2320 g	1500 ppm
	Site: FIRE PUMP EQUIPMENT WEST SECTION - (PUMP CONCRETE PAD) - WALL/COLUMN - GREY PAINT ON CONCRETE				
3	*551804039-0003*	4/6/2018	4/13/2018	0.2266 g	25000 ppm
	Site: FIRE PUMP EQUIPMENT WEST SECTION - (VALVE) - MECAHNICAL - DARK GREEN PAINT ON METAL				
4	*551804039-0004*	4/6/2018	4/13/2018	0.2396 g	2100 ppm
	Site: FIRE PUMP EQUIPMENT WEST SECTION -(CONNECTION) - MECHANICAL - LIGHT BLUE PAINT ON METAL				
5	*551804039-0005*	4/6/2018	4/13/2018	0.2287 g	<87 ppm
	Site: FIRE PUMP EQUIPMENT WEST SECTION - (VALVE) - MECHANICAL - BRIGHT GREEN PAINT ON METAL				
7	*551804039-0006*	4/6/2018	4/13/2018	0.2269 g	75000 ppm
	Site: FIRE PUMP EQUIPMENT EAST SECTION - (PIPE) - SILVER PAINT ON METAL				
8	*551804039-0007*	4/6/2018	4/13/2018	0.2383 g	35000 ppm
	Site: FIRE PUMP EQUIPMENT EAST SECTION - (PIPE) - YELLOW PAINT ON METAL				

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 04/19/2018 08:20:00

OrderID: 551804039

EMSL CANADA, INC.
LABORATORY•PRODUCTS•TRAINING

Lead (Pb) Chain of Custody

EMSL Order ID *(Lab Use Only)*: 551804039

EMSL CANADA, INC.
UNIT 48, 2333 18 AVE NE
CALGARY, AB T2E 8T6
P: 403-879-1149
F: 403-879-1152

Company : WSP Canada Inc.	EMSL-Bill to: ☒ Same ☐ Different If Bill to is Different note instructions in Comments**
Street: 237 - 4 Avenue SW, Suite 3300	*Third Party Billing requires written authorization from third party*
City: Calgary / State/Province:	Zip/Postal Code: T2P 4K3 / Country: Canada
Report To (Name): Daria Klimenko	Telephone #: 403-389-8732
Email Address: daria.klimenko@wsp.com	Fax #: / Purchase Order:
Project Name/Number: Hazmat Survey/181-01555-00 Drumheller Institutional Central Heating Plant	Please Provide Results: ☐ Fax ☒ Email
U.S. State Samples Taken:	CT Samples: ☐ Commercial/Taxable ☐ Residential/Tax Exempt

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour	☐ 6 Hour	☐ 24 Hour	☐ 48 Hour	☐ 72 Hour	☐ 96 Hour	☒ 1 Week	☐ 2 Week

**Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide*

Matrix	Method	Instrument	Reporting Limit	Check
Chips ☒ % by wt. ☐ mg/cm² ☒ ppm	SW846-7000B	Flame Atomic Absorption	0.01%	☒
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter	☐
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter	☐
	NIOSH 7300 modified	ICP-AES/ICP-MS	0.5 µg/filter	☐
Wipe* ASTM ☐ non ASTM ☐ *if no box is checked, non-ASTM Wipe is assumed	SW846-7000B	Flame Atomic Absorption	10 µg/wipe	☐
	SW846-6010B or C	ICP-AES	1.0 µg/wipe	☐
	SW846-7000B/7010	Graphite Furnace AA	0.075 µg/wipe	☐
TCLP	SW846-1311/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-1131/SW846-6010B or C	ICP-AES	0.1 mg/L (ppm)	☐
Soil	SW846-7000B	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	SW846-7010	Graphite Furnace AA	0.3 mg/kg (ppm)	☐
	SW846-6010B or C	ICP-AES	2 mg/kg (ppm)	☐
Wastewater Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	SM3111B/SW846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.7	ICP-AES	0.020 mg/L (ppm)	☐
Drinking Water Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	☐
TSP/SPM Filter	40 CFR Part 50	ICP-AES	12 µg/filter	☐
	40 CFR Part 50	Graphite Furnace AA	3.6 µg/filter	☐
Other:				☐

Name of Sampler: Daria Klimenko | Signature of Sampler:

Sample #	Location	Volume/Area	Date/Time Sampled
	see excel attached and submitted online		

Client Sample #'s	-			Total # of Samples:	7
Relinquished (Client):	Daria Klimenko	Date:	April 11, 2018	Time:	10am
Received (Lab):		Date:		Time:	

04-11-18 12:24 RCVD Courier STL

Controlled Document — Lead (Pb) COC – R6– 6/12/2012

page 1 of 1

2APR 18 11:11AM

FDX 7719 7175 Page 1 Of 2

Issue ID	Area	Location	Material structure	Material description	Date
1	Fire Pump Equipment West Section_I	{Pump }	Mecanical	{Red} paint on metal	2018-04-06
2	Fire Pump Equipment West Section_I	{Pump Concrete Pad}	Wall/Column	{Grey} paint on concrete	2018-04-06
3	Fire Pump Equipment West Section_I	{Valve}	Mecanical	{Dark green} paint on metal	2018-04-06
4	Fire Pump Equipment West Section_I	{Connection}	Mecanical	{Light blue} paint on metal	2018-04-06
5	Fire Pump Equipment West Section_I	{Valve}	Mecanical	{Bright green} paint on metal	2018-04-06
7	Fire Pump Equipment East Section_L	{Pipe}	Pipe	{Silver} paint on metal	2018-04-06
8	Fire Pump Equipment East Section_L	{Pipe}	Pipe	{Yellow} paint on metal	2018-04-06

APPENDIX

C ASBESTOS SPECIFICATIONS

PART 1 - GENERAL

1.1 General And Related Work

.1 Read this Section in conjunction with all other Sections so as to comply with the requirements of the General Conditions of the Contract.

.2 The site conditions identify the locations and condition of all known asbestos-containing materials projected to be disturbed by the work of this contract. The specification fulfills the requirements of the report required by the Section 34 of the *Alberta Occupational Health and Safety Regulation* (Alberta Queen's Printer, 2018) and Sections 3.2.2 and 5.5.8 of the *Alberta Asbestos Abatement Manual* (Government of Alberta, 2012) hereafter referred to as 'The Regulations'.

.3 Unless otherwise shown or specified it is the intent that Work performed as per this Section will result in the removal and disposal or decontamination of all asbestos-containing materials (ACMs) and all materials, which have been contaminated by ACMs.

1.2 Site Conditions

.1 The report entitled *"Asbestos and Lead Testing, Drumheller Institution, Drumheller, Alberta"* conducted by WSP Canada Inc., dated June 6, 2018 forms part of the Site Conditions of this Section of the Specification.

.2 Notify Owner Representative of suspect asbestos-containing materials discovered during Work that were not apparent from drawings, specifications, or reports pertaining to Work. Do not disturb such material until instructed by Owner Representative.

1.3 Outline of Work

.1 Requirements and procedures for asbestos abatement of the following ACMs:

.1 Removing ACM cement paste present on flanged connections, around valves, and pipe elbows in the fire pump room and at flanged connections in the tank room at the proposed work area.

.2 Removing non-ACM joint tape compound and fiberglass insulation around the cement paste.

1.4 Action and Information Submittals

.1 Submit an Asbestos Project Notification Form to Occupational Health and Safety within 72 hours of the work including set-up operations.

.2 Submit proof satisfactory to Owner Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

.3 Submit proof of Contractor's Asbestos Liability Insurance.

.4 Submit Workers Compensation Board status and transcription of insurance.

.5 Submit to Owner Representative procedures to deal with emergencies such as fire or injuries.

.6 Submit to Owner Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.

.7 Submit proof satisfactory to Owner Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.8 Submit proof of asbestos abatement course attendance, of not less than two days duration.

.9 Submit proof satisfactory to Owner Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

.10 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS's) for required chemicals or materials.

1.5 Personal Protection

.1 Instruct personnel in use of respirators, use of Glove Bags,

and all aspects of work procedures and protective measures.

.1 A competent person as defined by the Occupational Health and Safety Act must provide instruction.

.2 Supply negative pressure non-powered half-face respirators, with high efficiency (P100) cartridge filters, certified by the National Institute of Occupational Safety and Health (NIOSH) or other testing agency acceptable to the Ministry of Labour.

.1 Personnel must wear respirators at all times during Glove Bag installation, use, or removal and during final cleaning of piping.

.2 Maintain respiratory equipment in proper functioning and clean condition.

.3 Filters used shall be replaced or tested according to the manufacturers specifications and replaced as necessary.

.4 Ensure that no person required to use Glove Bag has facial hair, which affects the seal between respirator and face.

.3 Provide personnel with full body coveralls including attached head covering. Once coveralls are worn they must be treated and disposed of as asbestos contaminated waste.

.1 Personnel must wear coverall during installation, use, or removal of Glove Bag and during final cleaning of piping.

.4 Utilize hard hats, safety shoes and other protective apparel.

.5 Workers shall not eat, drink or smoke in Asbestos Work Area.

.6 Ensure workers are fully protected as specified above at all times when possibility of disturbance of ACM exists.

1.6 Authorized Visitor Protection

.1 Provide clean protective clothing and equipment and approved respirators to Authorized Visitors.

.2 Ensure Authorized Visitors have received required training for entry into Asbestos Work Area.

1.7 Air Monitoring

.1 Air monitoring may be performed using Phase Contrast Microscopy (PCM) following the National Institute for Occupational Safety and Health method 7400.

.2 Co-operate with the Asbestos Abatement Consultant in collection of air samples, including providing workers to wear sampling pumps at least once per shift. Contractor's forces must exercise care with Asbestos Abatement Consultant's equipment.

.3 Results of PCM samples that show airborne fibre levels above background levels, outside Asbestos Work Area, will indicate asbestos contamination of these areas. The contaminated areas shall be isolated and cleaned in the same manner applicable to the Asbestos Work Area, at no cost to the Owner. The area will be considered contaminated until visually inspected and air-monitoring results are show airborne fibre concentrations at or below background levels.

.4 PCM samples may be collected from within the Asbestos Work Area, after the site has passed a visual inspection and an acceptable coat of lock-down agent has been applied to all surfaces of piping from which ACM has been removed. These airborne fibre levels must be less than 0.01 fibre/cc. If these results show fibre levels in excess of 0.01 fibre/cc, Contractor shall re-clean the entire Asbestos Work Area and apply another acceptable coat of lock-down agent to all surfaces. These actions will be repeated until fibre levels are less than 0.01 fibre/cc.

1.8 Inspection

.1 From commencement of work until completion of clean-up operations, the Asbestos Abatement Consultant will be present periodically on site.

.2 Inspection of the Asbestos Work Area will be performed to confirm compliance with the requirements of the specification and governing authorities. Any deviations from these requirements that have not been approved in writing may result in a stoppage of work, at no cost to the Owner.

.3 The Asbestos Abatement Consultant is empowered by the Owner to inspect adherence to specified procedures and

materials, and to inspect for final cleanliness and completion. Additional labour or materials expended by Contractor to provide performance to the level specified shall be at no additional cost.

.4 The Asbestos Abatement Consultant is empowered by the Owner to order a shutdown of work when a leakage of ACM from the controlled work area has occurred or is likely to occur. Additional labour or materials to rectify unsatisfactory conditions shall be at no cost to the Owner.

.5 Materials and equipment must meet approval of the Asbestos Abatement Consultants. Unacceptable materials shall be replaced at no cost to the owner.

PART 2 - PRODUCTS

2. Materials and Equipment

.1 Asbestos Waste Container: An impermeable container acceptable to disposal site, and identifying its contents, hazards and necessary precautions for handling the waste materials. Comprised of one of the following:

.1 A sealed Glove Bag, inside a 6 mil (0.15 mm) sealed polyethylene bag.

.2 A sealed Glove Bag, inside a rigid sealed container of sufficient strength to prevent perforation of the container during filling, transportation and disposal.

.2 Glove Bag: Manufactured Glove-Bag in configurations suitable for work. If bag is to be removed from a pipe for use on a new section of pipe, bag must have a closure strip.

.3 HEPA Vacuum: Vacuum with necessary fittings, tools and attachments. Discharged air must pass through a HEPA filter.

.4 Knife: Knife with fully retractable blade for use inside Glove Bag.

.5 Lock-down Agent: Sealant for purpose of trapping residual dust. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry. Lock-down

agent shall be compatible with replacement insulation or fireproofing where required and capable of withstanding service temperature of substrate.

.6 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.

.7 Protective Coveralls: Disposable full body coveralls complete with hoods, manufactured of a material, which does not permit penetration of asbestos fibres.

.8 Rip-Proof Polyethylene Sheeting: Minimum requirements: 8 mil (0.20 mm) fabric made up from 5 mil (0.13 mm) weave and 2 layers of 1.5 mil (0.05 mm) poly laminate. In sheet size to minimize on-site seams and overlaps.

.9 Securing Straps: For Glove Bag, reusable nylon straps at least 1" wide with metal tightening buckle for sealing ends of bags around pipe and/or insulation.

.10 Sprayer: Garden reservoir type, low velocity, capable of producing mist or fine spray.

.11 Tape: Fibre reinforced duct tape suitable for temporary repair of damaged insulations.

.12 Wetting Agent: Non-sudsing surface-active agent. Acceptable product Aqua-Gro or approved equal.

PART 3 - EXECUTION

3.1 Preparation

.1 Isolate Asbestos Work Area with tape barriers, saw-horses or other barriers.

.1 Signs are to be displayed in all areas where access to Asbestos Work Area is possible. Such signs shall read:

CAUTION
Asbestos Dust Hazard
Avoid Breathing Dust
Wear Protective Equipment
Breathing Asbestos Dust May Cause Cancer
Entry is Prohibited Except to Authorized Persons

Eating, Drinking and Smoking are Prohibited in this Area

3.2 Pipe Insulation Removal

.1 Prior to use of Glove Bag on damaged or unjacketed insulation:

.1 Place polyethylene drop sheet under piping.

.2 Spray any areas of damaged insulation jacketing with mist of amended water.

.3 Tape over damaged insulation to provide temporary repair.

.4 Mist areas of insulation with no jacketing and wrap with polyethylene sheeting.

.5 Clean surface using HEPA vacuuming or damp wiping where minor amounts of fallen or damaged insulation.

.2 Place any tools necessary to remove insulation in tool pouch built into Glove Bag. Insert nozzle of spray pump into bag through valve and seal the opening. Insert nozzle of vacuum cleaner fitted with HEPA filter into the bag and seal the hole.

.3 Install Glove Bag as per manufacturers instructions.

.4 Seal valve cover with wire tie or equivalent on valve Glove Bags.

.5 Remove insulation from pipe as per manufacturer's directions.

.6 Volume and weight of insulation must not exceed capacity of bag or supports.

.7 Arrange insulation in bag to maximize use of bag.

.8 Remove metal jacketing or banding carefully to minimize the possibility of ripping or puncturing bag.

.9 Insert nozzle of spray pump into bag through valve and clean pipe and interior of upper section of bag thoroughly. Use one hand to aid washing process. Wet surface of insulation in lower section of bag and any exposed end of asbestos insulation remaining on pipe by spraying with water. Apply sealant to the inside upper section of the bag prior to removal

of the bag.

.10 If bag is to be removed from a pipe for use on a new section of pipe, perform the following:

.1 Wash top section of Glove Bag thoroughly. Place all tools in the lower pouch of the glove bag (below the closure strip).

.2 Insert nozzle of HEPA filtered vacuum cleaner into bag through valve and evacuate air from bag.

.3 Seal closure strip. Remove bag from pipe and seal in new location before reopening closure strip.

.11 Loosen holding straps and carefully move bag and re-seal to pipe using double-pull zipper to pass hangers if bag is to be moved along the same pipe. Repeat insulation removal operation.

.12 Cease work and repair opening if, during use, the Glove Bag is ripped, cut or opened in any way. Utilize hood on disposable coverall if bag becomes cut or opened in any way.

.13 Clean up and remove with a HEPA vacuum all spilled material.

.14 To remove bag after completion of insulation removal operation:

.1 Wash top section of Glove Bag and tools thoroughly. Place all tools in one hand (glove), pull hand out inverted, twist to create a separate pouch, tape inverted hand at two separate locations 2.5 cm apart so as to seal pouch. Remove inverted hand and tools by cutting between the two tape seals.

.2 Place inverted hand pouch and tools into the next clean Glove Bag to be used or into a water bucket, open pouch underwater and clean tools and then allow drying.

.3 Insert nozzle of HEPA filtered vacuum cleaner into bag through valve and evacuate air from bag. Keep vacuum operational during removal of glove bag from pipe.

.4 Remove nozzle of vacuum and tape over end of valve.

.5 Pull a 6-mil polyethylene bag over glove bag before removing from pipe. Remove securing straps. Unfasten zipper. Seal Glove Bag and seal 6-mil polyethylene bag

so as to create asbestos waste container. Dispose of as asbestos waste.

.15 Ensure pipe is clean of all residues after removal of Glove Bag. If necessary, after removal of each section of asbestos, vacuum all surfaces of pipe, using HEPA vacuum or wipe with wet cloth.

.16 Seal all surfaces of freshly exposed pipe with Lock-down Agent. Cover exposed ends of any remaining asbestos insulation with lagging cloth or tape.

.17 Remove drop sheets and dispose of as asbestos waste.

3.3 Waste and Material Handling

.1 Ensure ACM or asbestos-contaminated materials removed during work are treated, packaged, transported and disposed of as asbestos waste.

.2 Transport asbestos contaminated waste to a licensed landfill.

END OF SECTION